E-Learning for Knowledge Management in Technical Vocational Education and Training Colleges

by

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submitted in accordance with the requirements for
the degree of

MAGISTER TECHNOLOGIAE

in the subject

INFORMATION TECHNOLOGY

at the

UNIVERSITY OF SOUTH AFRICA

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NOVEMBER-2018

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E-Learning for Knowledge Management in Technical Vocational Education and Training Colleges

I declare that the above dissertation is my own work and that all the sources that I have used or quoted have been indicated and acknowledged by means of complete references.

SIGNATURE

25/10/2018

DATE

ACKNOWLEDGEMENTS

Firstly, I want to thank God almighty for giving me the strength, courage and knowledge to pursue this project to the end.

First and foremost, I am indebted to my supervisor, Professor Ernest Ketcha Ngassam, who has been very supportive at all stages of this work. I wish to express my utmost gratitude to him for his invaluable advice and patience in reading, correcting and commenting on the draft of the dissertation, and more importantly, for his belief in paving a better future for generations to come which has made me feel more confident during the study period.

I am also grateful to professional editor, Dr Richard Steele for his helpful comments on the grammar and spelling in this dissertation.

I am appreciative to my dearly wife Mrs SP Dhlamini, my children Siyonqoba, Bambiswano, Mpendulo and Lulonke who stood by me during my studies.

I am grateful to my father Mr MS Dhlamini and my late mother Mrs NM Dhlamini for instilling in me the importance of education, and to my brother Mlungisi for offering me an opportunity to obtain my first post-school qualification which has made it possible for me to reach this level.

To my friend and colleague Mr Mbongiseni Michael Buthelezi thank you for your motivation that has helped me further my studies.

To Majuba TVET college and UNISA thank you for the environment which has made studying possible.

Many other colleges, colleagues and friends assisted in various ways who are worthy of special mention. It is, in fact, not possible to mention them all.

ABSTRACT

In TVET colleges, the traditional face-to-face mode of knowledge delivery appears to be the norm. Knowledge is often shared in a teaching space during a particular period of time. Students and a lecturer need to be in a specified venue during an allocated time slot for the learning process to take place which includes obtaining knowledge from the lecturer, sharing views and storing knowledge in their minds. There is often no interaction with the lecturer beyond the classroom. As such, learners with learning difficulties have no alternative platform into which they can get support; which compromises the quality of education and students' success rate.

The use of e-learning permits students to finalise a course in their own time and at their own location. It also implies that students are at an advantage as they do not need to go to a particular learning institution, and they can proceed with the training at their own pace.

This research investigated how e-learning may be used as an enabler of learning by overcoming barriers associated with face-to-face learning. This was achieved through the development of a proposed e-learning framework based on the existing literature. The proposed framework was then tested through a survey distributed among TVET stakeholders to offer an improved framework. Furthermore, the improved framework was used to develop an e-learning architecture and prototype which can help guide institutions who wish to adopt e-learning.

Keywords: Knowledge, e-learning, Knowledge Management, Knowledge Sharing, e-learning Framework, e-learning Architecture, e-learning Prototype, Part-time learning, Distance learning, Online participation

LIST OF ACRONYMS AND ABBREVIATIONS

ADDIE – Analyse, Design, Develop, Implement, Evaluate
AE – Artisan Education
CDs – Curriculum Designers
CoP – Community of Practice
DBE – Department of Basic Education
DHET – Department of Higher Education and Training
DL – Distance learning
DoE – Department of Education
EF – E-learning Framework
E-learning – Electronic learning
FET Colleges – Further Education and Training Colleges
FTL – Full-time learning
ICASS – Internal Continuous Assessment
ICT – Information and Communication Technology
ILT – Instructor-led training
ISAT – Integrated Summative Assessment Task
IT – Information Technology
KM – Knowledge Management
KMS – Knowledge Management System
KS – Knowledge Sharing
KSF – Knowledge Sharing Framework
LMS – Learning Management System
MCoP – Mobile Community of Practice
MPI – Merrill's Principles of Instruction
NATED – National Accredited Technical Diploma
NCV – National Certificate Vocational
NSF – National Skills Fund
ODL – Open Distance Learning
OE – Occupational Education
Online ILT – Online Instructor-led training
OLM – Online Learning Model

OP – Online participation

PTL – Part-time learning

RADDIES – Requirements, Analyse, Design, Develop, Implement, Evaluate & Apply changes, Support

SAQA – South African Qualifications Authority

SDLC – Software Development Life Cycle

SETA – Sector Education and Training Authority

TVET Colleges – Technical Vocational Education and Training Colleges

VCoP – Virtual Community of Practice

VE – Vocational Education

VET – Vocational Education and Training

Video ILT – Video Instructor-led training

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1. Introduction of the study

1.1. Introduction

(BusinessDictionary.com, 2013), defines education as the body of knowledge obtained by a person after learning specific course materials or through life experience that offers an understanding of something. Furthermore, it requires some sort of coaching from someone or existing writings. The multiple practices of education result from years of studying that combines training in a variety of subjects. According to (Jan, 2002; Banks, Carson, & Nelson, 2001), education started in ancient history as grown-ups taught the young knowledge and skills considered essential in the development of their humanity and was done vocally and by means of simulation. Story-telling distributed values, skills, and knowledge from one age band to the succeeding one. (Serban, Luan, & Jing, 2002) named the practice where knowledge (that is skills, expertise, or information) is transferred among, friends, families, institutions, people or communities as knowledge sharing (KS) and knowledge is exchanged within a community of practice (CoP), which is a set of individuals that share expertise and/or a line of work (Lave, Jean; Wenger, Etienne, 2005). In TVET colleges students, lecturers, organisations, college management from various levels form the CoP and one of their common goals is to increase not only the certification rate, but also the quality and relevance of knowledge transmitted to learners.

According to (EMC2, 2013; Training Room, 2014) we have various modes of learning (methods for KS) which include instructor-led training (ILT), video instructor-led training (Video ILT / Video ILT-Stream), online instructor-led training (Online ILT), e-learning and blended learning. Among all these modes, the most used in TVET colleges is the ILT mode also known as the traditional face-to-face mode of learning. (Clark, 2015), argues that the traditional face-to-face mode in higher education all over the world does not take into consideration the psychology of learning in which learners are exposed to dull hourly lectures and taught inappropriate content. According to (Henry, 2007), in the traditional face-to-face mode, students cannot gain or share knowledge if for some reason they cannot make it to the college. Non-attendance disrupts the vibrant teaching-learning setting and disturbs the complete

well-being of lessons (Senegal, 2008). In proper terms, non-attendance is a waste of learning assets, time and human talent. Additionally, students' non-appearance leads to repeated work and lost time for educators. Educators that use lesson time re-teaching classes take learning opportunities away from learners who regularly appear in class. The additional time consumed working on absentees' activities steals time from lecturers' preparation periods and time required to deliver individual support (Weller, 1996). The literature indicates that students who constantly fail to make it to campus have poor success rates and can be penalised on assessment marks (Barker & Jansen, 2000). Continuous absenteeism may disturb retention because it can result in dropout (Lotz & Lee, 1999).

E-learning, according to (VirtualCollege, 2012), is a virtual form of learning offered through a computer in a campus-based or distance learning course. This study proposes to develop an e-learning framework for facilitating KS and CoP in TVET colleges of South Africa. E-learning allows lecturer-to-student, lecturer-to-lecturer and student-to-student interactions online for distance learning, part-time and full-time studies. Such learning includes discussions, submission of assessments, publication of notices and any other relevant activities necessary to support teaching and learning which allows absent students to learn anywhere at any time. According to (Mchombu, 2013), the e-learning mode is valuable because it is flexible and cost effective. Due to these benefits, e-learning may be utilised by persons and organisations that need workers to gain new skills quickly without physically going to a distant learning institution. Due to the flexibility of this approach one can expect students to spend more time learning, participating and sharing their views on given topics. Information on online discussions is permanently available to students which allow them to refer to such information when studying for examinations thus improving the student pass rate.

1.2. Research background and motivation

In TVET colleges the traditional face-to-face mode of delivery is still dominant. Neither individual nor institution will ever realise perfection. However, efforts are ongoing to continually improve upon educational systems (OECD, 2010c).

A challenge with the traditional face-to-face mode, according to (Jones, 2011), is poor student commitment which prompts disruption, tiredness and a dislike for learning. A large number of students feel obliged to prepare documents and determine solutions in line with what the teacher requires which is different from giving answers based on one's own knowledge. This methodology does not empower basic or inventive reasoning aptitudes. (Pappas, 2013), indicates that students be encouraged to write for ordinary people instead of their lecturer only. This approach involves outlining individual points of view relating to the topic as opposed to merely imitating the lecturer's or the textbook's views which negatively influences learners' performances and achievement rate. The commitment level of learners is improved with the technology-rich learning modes. There is broad proof that ICT expands inspiration, certainty and commitment (Blamire, 2009). E-learning, also known as technology-based learning, enhances learners' commitment as well as furnishes them with abilities for life-long learning including innovative education. Individuals, who do not possess the competences of using technology, affect their ability to successfully work and flourish in the new information economy. Indeed, innovation is an essential component of higher-order abilities often referred to as 21st century skills, which are important before being productive in the present society (OECD, 2010b).

However, there are very few TVET colleges who apply e-learning systems and it is hoped that the current study encourages TVET colleges to make use of an e-learning framework. Online learning improves the entire process of acquiring, retaining, storing, communicating and sharing knowledge among community of practice (student-to-student, student-to-lecturer and lecturer-to-lecturer). One can simply go online anywhere and at any time to obtain information and share views. Since such information is permanently available online, one can also refer to such when preparing for assessments or/and examinations which is not the case with the face-to-face mode because one can easily forget important points raised in class. The use of e-learning results in high student retention and success rates as the quality of learning improves. We cannot flee from the reality that not every person learns similarly, or at a similar pace. Some prefer a classroom situation while others do well with self-guided strategies that are less demanding on time and finances (EMC^2, 2013). The flexibility of online learning is capable of accommodating most

students. The purpose of this study is to develop an e-learning framework for facilitating KS and CoP in TVET colleges in South Africa. E-learning can help with handling many issues, including expanding access to quality instruction, offering help for battling learners, contributing towards lecturers' preparation and expert improvement and enhancement of administration and organisation at TVET colleges.

1.3. Problem statement

In TVET colleges, the traditional face-to-face mode of delivery is dominant. Knowledge is normally shared in a classroom during a particular period of time. Students and a lecturer need to be in a specified venue during the particular period for the learning process to take place which includes obtaining knowledge from the lecturer, sharing views and storing knowledge (Burgess, 2015).

A number of challenges have been reported with the face-to-face mode of delivery such as that the time allocated is too limited and the students and lecturer are bound by geographic location. There is no interaction with the lecturer beyond the classroom, which means that learners with learning difficulties have no alternative platform into which they can obtain support. This is also the case with the learners who cannot make it to college for some reason; they cannot learn away from the college which compromises the quality of education and students' success rate. (VirtualCollege, 2012), argues that the utilisation of e-learning lets students finish the course at a location and time suitable for them. This approach may ensure that disturbances in a hectic working day are reduced. Students' are at an advantage as they can catch up on training wherever they may be without travelling to a particular physical location. However, there are very few TVET colleges who apply an e-learning system, hence the importance of undertaking an investigation such as this on the formation of an e-learning framework for facilitating KS in TVET colleges. Having such a framework could significantly contribute to resolving the various educational challenges faced by students and learners in these communities.

1.4. Research objectives

The main objective of this study is to develop an e-learning framework for facilitating KS and CoP in TVET colleges. This is achieved by means of the fulfilment of the specific sub-objectives listed below:

Sub-objective 1: To investigate the state-of-the-art of KS in TVET colleges.
Sub-objective 2: To investigate the suitability of e-learning as a mechanism to overcome challenges faced by TVETs with regard to KS.
Sub-objective 3: To develop an e-learning framework on which TVETs can rely to effectively and efficiently share knowledge among stakeholders.
Sub-objective 4: To evaluate and validate the framework in the real-life environment of identified TVET colleges.

1.5. Research questions

The main research question of this study is:

- How can we develop an e-learning framework for facilitating KS and CoP in TVET colleges?

The main research question is answered through the following specific research questions:

Research Question 1: What is the state-of-the-art of KS in TVET colleges? The activity associated with this research question is to explore the literature on KS in TVET colleges. As such, the outcomes of the literature search help identify the shortcomings of the various approaches used to share knowledge in these institutions. This forms the basis for exploring avenues for improvement in later research questions.

Research Question 2: How can e-Learning be used to overcome the challenges currently faced by TVET colleges with regard to KS? The activity associated with this research question is to explore the literature on how e-learning is being used to overcome the challenges currently faced by TVET colleges with regard to KS. The outcomes of the literature search help identify ways in which e-learning can be used

to address the shortcoming on the various approaches used to share knowledge in these institutions. This forms the basis for exploring an e-learning framework in Research Question 3.

Research Question 3: How can we develop an efficient e-learning framework for facilitating KS among TVET stakeholders? This question involves collecting inputs from the literature on the development of a proposed e-learning framework which is later evaluated by TVET stakeholders for the development of the improved framework.

Research Question 4: Which techniques can be used to evaluate and validate the framework in the real-life environment of identified TVET colleges? The activity here is to obtain input from respondents as they evaluate and validate the appropriateness of the proposed framework in the real-life environment of those TVET colleges that are within reach in order to develop an improved framework from which e-learning architecture and prototype is developed.

1.6. Research methodology

In this study both quantitative and qualitative methodologies are used. (Stainback & Stainback, 1984) sum up the direct difference between the quantitative and qualitative methodology as follows: the intention of a quantitative study is to assess objective data that comprises numbers whereas qualitative research works on subjective data which are formed by the thoughts of interviewees or respondents (that are human beings). Qualitative data are offered in a language format. Stainback further says that quantitative methodology is used to get statistical information and closed-ended questions are used, while a qualitative methodology is used to get detailed information from the participants using open-ended questions.

The foregoing methodological approach enables us to rely on the analysis of respondents' perspectives for the improvement of the proposed conceptual framework. Furthermore, for the purpose of demonstrating to the reader that the improved framework can be implemented in real life, the prototyping approach is used as guideline for the formation of an e-learning system that relies on an

improved framework. Table 1.6 lists each research question against the potential research methods utilised to gain the answers to each question.

Research Questions	**Research Methods**
Sub objective 1: To investigate the state of the art of knowledge sharing in TVET colleges.	
Research Question: What is the state-of-the-art of knowledge sharing in TVET colleges?	**1.** Literature Review **2.** Data Analysis
Sub objective 2: To investigate the suitability of e-Learning as a mechanism to overcome challenges faced by TVET with regard to knowledge sharing.	
Research Question: How can e-learning be used to overcome the challenges currently faced by TVET colleges with regard to knowledge sharing?	**1.** Literature Review **2.** Data Analysis
Sub objective 3: To develop an e-Learning framework, one which TVET can rely on effectively and efficiently share knowledge among stakeholders.	
Research Question: How can we develop an efficient e-learning framework for facilitating knowledge sharing among TVET stakeholders?	**1.** Proposed Conceptual Framework Development (based on findings in the literature)
Sub objective 4: To evaluate and validate the framework in a real-life environment of identified TVET colleges.	
Research Question: Which techniques can be used to evaluate and validate the framework in a real-life environment of identified TVET colleges?	**1.** Survey/Questionnaire (for Evaluation and Validation of the proposed framework) **2.** Qualitative and Quantitative Analysis **3.** Improved Conceptual Framework Development (based on input from respondents) **4.** Develop an Architecture of the improved framework **5.** Develop a Prototype Design of the improved framework as proof that it can be used in real-life environment

Table 1.6: Methodology adopted per research objective and question

As per Table 1.6 the research methods presented below are employed for this research.

Literature review: According to (Taylor, 2011), a literature review refers to existing research that has been published on the matter by qualified academics. This study helps enlarge knowledge which assist in the achievement of the abovementioned sub-objectives and allow us to utilise values of research analysis to find equitable and valid studies. Literature relating to the topic were explored.

Data analysis: According to (BusinessDictionary.com, 2012), data analysis is a way to assess information utilising explanatory and sensible thinking to inspect every part of the information provided. This type of investigation is only one of the numerous means that must be finished when directing a research experiment. In this research study data from previous literature relating to the topic are gathered, reviewed, and then analysed to form findings, conclusions and recommendations.

Conceptual design: This covers the techniques, analysis, strategies and research in terms of 'design'. It supports the idea of, and thought processes related to, creative work. Conceptual design, together with design, is driven by a specific setting under which it is functioning. It differs from other disciplines that may study their subjects experimentally or empirically, because design focuses on altering the setting (Mareis, 2011). Based on the analysed findings from the literature review regarding frameworks of KS and e-learning, we conceptually design an e-learning framework that can be used as an enabler for KS in TVET colleges. The aim is to provide a technical environment where students and lecturers can share knowledge which may substitute or/and supplement classroom learning.

Survey/questionnaire: A survey is a data collecting technique that is used to pull together, analyse and interpret the views of a set of persons from a target population. Surveys are utilised in many areas of research which include marketing research, sociology, psychology and politics (Sincero, 2012; Gault, 1907). In a survey-based research study a questionnaire is used. A questionnaire is an instrument that consists of a set of questions asked of the respondents of the survey. Questionnaires frequently ask questions that stimulate preferences, attitudes, traits, ideas, facts and behaviours. In the current study a questionnaire is administered by means of face-to-face and online methods. An online survey, or web-based survey, is a commonly used survey technique which calls for respondents to answer the questionnaire virtually, over the internet. The purpose of the survey is to improve the proposed conceptual framework based on respondents' feedback. The questionnaire is built around the proposed conceptual framework and questions are designed around aspects of the framework such that responses could be gathered and analysed in order to discover avenues for the improvement of the framework.

As such the purpose of the questionnaire is to evaluate the framework for further improvements before the development of the architecture and prototype.

Quantitative and qualitative analysis: According to (Investopedia, 2009), qualitative analysis is an investigation that uses subjective judgement in relation to unquantifiable data, for example, mastery of administration, industry cycles, quality of innovative work, and work relations. Qualitative investigation is different to quantitative examination, which is related to numbers that can be established on reports. Both methods are utilised together, with the end goal of investigating the possibilities of e-learning and assess its potential as the provider of useful training. This approach is used to analyse the survey questionnaire and feedback received from the evaluation of the proposed framework helps improve the proposed framework.

Evaluation and validation: To evaluate means to show the usefulness of the system and to validate means to show that the right system was built (FHWA, 2012). The proposed framework is evaluated and validated to provide further recommendations for improvement on the framework based on the respondents' feedback.

Prototype development: According to (SearchManufacturingERP, 2010), a prototype is a basic functioning model of a system, frequently put together for demonstration or as a deliverable of the development process. In the systems development life cycle (SDLC), a prototype model of the system is created, tested and then revised as required until a satisfactory prototype is finally realised from which the whole system can be created. After providing the conceptual design of the improved framework, the e-learning prototype is developed and used as a guideline to show that the framework can be implemented in a real-life environment.

1.7. Research outcomes

This research produces a range of outcomes, namely:

A proposed conceptual e-learning framework derived from the critical analysis of research findings in the literature on the current state of the art of knowledge delivery in TVETs.

An improved e-learning framework based on the analysis of questionnaires from participants drafted according to the initial proposed conceptual framework.

An e-learning architecture and prototype of the improved framework to demonstrate that the improved framework can be implemented in real-life.

1.8. Scope and limitations

This study is limited to the development of an e-learning framework for facilitating KS with the CoP in TVET colleges. Only a limited number of TVET colleges in South Africa that are within our reach are considered for the evaluation and validation of the findings.

1.9. Chapter outline

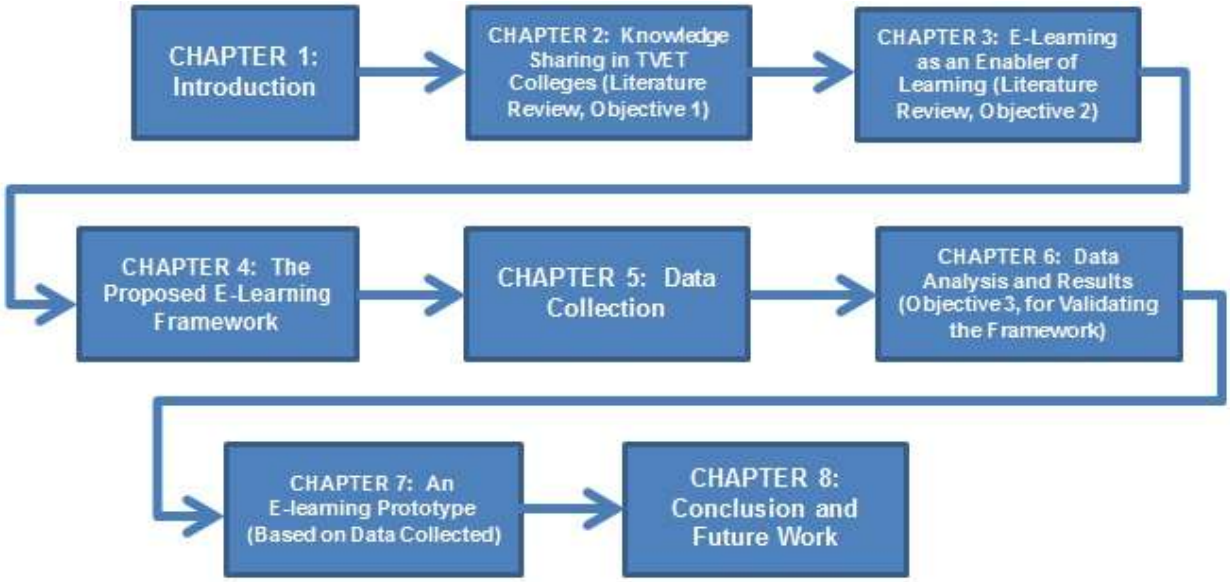

Figure1.9: Chapter Outline

The dissertation includes the chapters as shown in Figure 1.9. Below the purpose of each chapter is discussed.

CHAPTER 1: Introduction

This chapter offers the reader an indication of what the entire study entails; it is the cornerstone of the study.

CHAPTER 2: Knowledge Sharing in TVET Colleges (Literature Review, Objective 1)

This chapter responds to sub-objective 1 by exploring the literature in order to understand the current state of KS in TVET colleges.

CHAPTER 3: E-Learning as an Enabler of Learning (Literature Review, Objective 2)

This chapter fulfils sub-objective 2 by exploring from the literature how e-learning can become a solution to current challenges associated with KS in TVETs.

CHAPTER 4: The Proposed E-Learning Framework for TVET colleges (Literature Review, Objective: First Contribution of The Research)

This chapter fulfils sub-objective 3 which is to develop an e-learning framework, on which TVETs can rely in order to effectively and efficiently share knowledge among stakeholders. The proposed framework is presented based on a thorough study conducted on the existing KS modes, e-learning frameworks and e-learning models explored in this study.

CHAPTER 5: Data Collection

This chapter replies to sub objective four by describing how the proposed framework is evaluated and validated. The instrument used to evaluate and validate the proposed framework in a real-life environment of identified TVET colleges is also described.

CHAPTER 6: Data Analysis and Results (Objective 3, for Validating the Framework)

In this chapter feedback from the respondents is analysed and used to develop an improved framework.

CHAPTER 7: Improved Framework and Framework Prototype (Based on Data Collected)

This chapter presents the improved framework developed based on the data collected from which an e-learning architecture and prototype is developed as proof that the improve framework can be implemented in real-life.

CHAPTER 8: Conclusion and Future Work

This chapter presents the contributions made to knowledge, the main research results, limitations of the study and suggestions for future research.

1.10. Preliminary literature review

This section offers a preliminary literature related to the topic of study. The literature was deliberated in relation to the research problem of this dissertation. (Naidu-Hoffmeester, 2013), states that when the concept of Open and Distance Learning (ODL) research was introduced, apprehension set in among academics and researchers, with some of them feeling that they were being dictated to on the type of research they can conduct. UNISA's Institute for Open and Distance Learning (IODL) insists that this is not the case. Hosting a workshop on the changing role of staff in ODL environments as part of the ODL research thrust, it was explained that academics and researchers were being encouraged to conduct ODL research based on the "problems" they experience with ODL. In addition, academics are encouraged to continue with their discipline-specific research but from an ODL perspective. "Research comes as a result of problems, so we can identify our ODL problems and turn them into research questions". We are of the belief that the same gaps or problems apply to TVET colleges as they look forward to making use of technology for distance learning (part-time and full-time), and this study focuses on distance learning (full-time and part-time) with the aim of overcoming challenges currently experienced with the traditional face-to-face method of KS.

In South Africa we do not have sufficient research which addresses challenges experienced with traditional face-to-face education. A number of researchers,

including (Díaz & Entonado, 2009; Aloraini, 2009), report that it has been discovered that the design and arrangement of the electronic content of a virtual course may, on occasion, be more acceptable and effective than those of a face-to-face programme. As a result, we hope to develop an e-learning framework for facilitating KS and CoP specifically for TVET colleges in South Africa. Most studies on e-learning have been performed in and for European countries. The findings from these studies are not necessarily relevant to South Africa because the populations used in these studies are not similar to the South African population in a number of respects such as behaviour, culture, access to technology, literacy levels and conditions. Therefore, this investigation is significant because it is important for TVET colleges to stay current with the modes of delivery including technology, especially when it brings about improvement in a manner in which knowledge is shared.

1.10.1. Knowledge sharing in TVET colleges

Institutions have acknowledged that knowledge constitutes a treasured immaterial asset for generating and preserving competitive gains. Knowledge sharing activities are usually sustained by knowledge management systems. We have various types of knowledge which include tacit knowledge and explicit knowledge. (Polanyi, 1966), initially introduced the word “tacit knowing” or “tacit knowledge” into philosophy in 1958 in his magnum opus Personal Knowledge. He notably sums up the concept in his later work The Tacit Dimension with the declaration that “we can know more than we can tell”. He mentions not only that there is knowledge that exists which cannot be sufficiently spoken, but that every form of knowledge is embedded in tacit knowledge.

Tacit knowledge is knowledge that individuals are not always mindful of the information they have or how it can be significant to others. Powerful exchanges of tacit knowledge require broad individual contact, consistent communication and trust (Goffin & Koners, 2011). This type of knowledge can only become visible through constant practice in a specific context and communicated through social networks (Schmidt & Hunter, 1993; McKinsey Global Institute, 2012). To a certain degree this knowledge is exposed when the knowledge holder connects to a network or a community of practice (Goffin & Koners, 2011). On the other hand, explicit

knowledge is knowledge which can be freely uttered, organised, retrieved and spoken (Helie & Sun, 2010). It is easy for it to be communicated to others. Numerous forms of explicit knowledge can be kept in different media. The knowledge kept in encyclopaedias and course books are good samples of explicit knowledge.

Technology is one of the many aspects that influence the sharing of knowledge in businesses, for example institutional culture, reliance, and encouragements (Cabrera & Cabrera, 2002). The sharing of knowledge institutes a key challenge in the arena of knowledge management since a number of workers are likely to resist sharing their knowledge with the whole institution. Even though knowledge is generally treated as an object, (Snowden, 2002) argued that it is more fitting to explain it as both a flow and a thing. Knowledge as a flow may be linked to the theory of tacit knowledge, revealed by (Polanyi, 2003), as explained by (Nonaka, 1994; Nonaka, 2009).

In TVET colleges the difficulties of sharing knowledge through the traditional face-to-face mode which is currently dominant have not been adequately resolved. We therefore agree with (Argote & Ingram, 2000; Fan, 1998) that it can prove helpful for TVET colleges to recognise the challenges that exist with particular knowledge transfer modes. This study investigated the suitability of e-learning as a mechanism to overcome challenges faced by TVET colleges with regard to KS.

1.10.2. The culture of effective knowledge sharing

According to (Pienaar, 2007), KS is an on-going value adding process (internal and external) where individuals willingly communicate their thoughts and experiences on a micro (personal), macro (departmental and group) and global (organisational which is the entire college) level. These individuals who share knowledge are referred to as a community of practice (CoP). The theory was initially proposed by (Lave, Jean; Wenger, Etienne, 2005). CoPs may develop naturally due to members' mutual interest in a specific field. It can also be formed deliberately with the aim of obtaining knowledge linked to a particular domain. The participants of the group learn from one another and stand a chance to grow themselves personally and workwise in the

process of exchanging information and experiences with the team (Lave, Jean; Wenger, Etienne, 2005).

CoPs can be present in a physical setting, such as a canteen at college, an office, a industrial unit, or somewhere else in the environment. However, it is not compulsory for individuals belonging to CoPs to be at the same geographic location. The members can make up a virtual community of practice (VCoP) (Dubé, Bourhis, & Jacob, 2005) the minute they interact online, for example within chat boards and newsgroups. A mobile community of practice (MCoP) occurs the moment members connect with each other using mobile devices and take part in community work wherever they are (Kietzmann, Jan; Plangger, Kirk; Eaton, Ben; Heilgenberg, Kerstin; Pitt, Leyland; Berthon, Pierre, 2013).

Thus, a community of practice can exist beyond a classroom which is something that TVETs have not fully utilised. This approach allows the CoP to get together without requiring a face-to-face setting. Table 1.10.2 compares the interaction between face-to-face and e-learning which is sometimes referred to as online learning.

	Online	**Face-to-Face**
Approach	Deliberations via text only; May be organised; Solid; Everlasting; Restricted; Plain	Spoken deliberations: a frequently used approach, but temporary
Sense of Educator Control	Less sense of educator control; Members may easily ignore an educator	More sense of control from educator; Members may not easily ignore an educator
Discussion	Group interaction constantly retained; Seriousness of analysis regularly increased; Discussions are endless, stop for a short period of time; Reflection rate is high; Easy to reshape discussion due to on-going tolerances and reflection	Less group interaction between gatherings; Analysis varies, dependent on time available; Discussions occur within a set of time frame; Often little time for reflection during meetings; Difficult to reshape discussion during a meeting

Group Dynamics	Less feeling of tension; More equivalent interest; Less pecking orders; Flows are 'covered up' yet traceable; No breaks, continually in the gathering; Can be undivided attention without investment; Medium (technology) has an effect; Different assumptions regarding cooperation; Slower, time delays in associations or talks	Tension at starting/amid gatherings; Participation unequal; Dynamics apparent yet lost after the occasion; Breaks between gatherings; Listening without investment might be disapproved of; Medium (room) may have less effect; Certain assumptions regarding cooperation; Quicker, quickness of collaborations or dialogues
Re-joining	Lots of psychological/emotional strain for re-joining	Less strain for re-joining
Feedback	Input on every individual's bit of work extremely point by point and concentrated; Whole gathering can see and read each other's criticism; No one can "cover up" and not give input; Permanent record of input received by everyone; Delayed response to input; Sometimes little exchange after input; Group takes a look at all members' work at same time	More averse to cover as much detail, frequently more broad dialogue; Group hears input; Verbal/visual criticism; Possible to "free-ride" and abstain from giving criticism; No everlasting record of input; Immediate responses to criticism conceivable; Usually some exchange after criticism, taking a look at more extensive issues; Group takes a look at one member's work at once
Divergence /Choice Level	Free bound nature energises dissimilar talk and unusual learning; Medium liberates the sender yet may confine alternate members (recipients) by expanding their vulnerability	All the more firmly bound, expecting adherence to acknowledged conventions; Uncertainty more improbable because of regular understandings about how to partake in discourses

Table 1.10.2: Online vs face-to-face settings (McConnell, 2000)

For students to realise the gains that e-learning has to offer; it is important that the online participation rate be high. Online participation describes the association among clients and online networks on the web. Online organisations frequently include individuals to give substance to the site and provide input. The subsections that derive from online involvement include commitment to online communities, co-ordination and interaction, and member recruitment. Online participation requires a culture that promotes an environment suitable for e-learning regarding KS. (Hofmann, 2012), lists the following sources of motivation that may help improve student participation on e-learning:

- **Distribute prerequisites and set desires early.** Getting more work than anticipated or taking a class that is not suitable is not just demotivating, it can be out and out irritating. To guarantee that students can meet desires, distribute them early.

  Make a webpage containing a point by point course portrayal, learning targets, work assignments, and a gauge of the time it takes to finish the greater part of the work. Clarify the innovation blend and any essential prerequisites. Furnished with enough data, learners can settle on an educated decision about the suitability of the course for them. Furthermore, if the course is required, people can attempt to adjust their calendars to suit the workload.

- **Set up significance.** Numerous associations have libraries with several off-the-rack web-based learning programmes. Before expecting somebody to take a course (off-the-rack or home-developed), a course provider should explain the reasons why the content is vital to the student. Once the learners know the importance of the course, their chances of completing the course increase.

- **Give non-stop support.** Email and message-type interchanges are simple approaches to support students on the web. Support can include posting a "Frequently Asked Questions" list on a discussion board, email updates and offers of help, or call students that are not signing on. Realizing that a genuine individual is looking over material humanizes the online condition and encourages students to remain engaged.

- **Utilize the assessments.** Surprisingly, appraisal has been recognized as a key inspiration for students on the web. Members realize that what they know will be evaluated. Offering tests that are in line with the syllabus motivates students to study. Distribute the course prerequisites and assessment methods, and let potential students realize that if they neglect to meet the

basic necessities required for the course, they will have to take the class again.

- **Get managers and an associate to help.** A difficult aspect of learning in the work context is the frequent interruptions by those working in the vicinity. Learners should decide what time they need to finish programmes, then notify their bosses and peers, and then should feel confident that the required time will be respected. Managers and colleagues can help employees achieve their study goals if they are informed accordingly. In any case, actually once a student is disturbed on a few times, retention falls and the number of students who finish the programme significantly goes down. However, disturbances can be minimized when managers are informed.

- **Advertise within, advertise nonstop.** In a connected globe, a message moves from one place to another quickly. Make sure the message regarding virtual learning is good, and frequently strengthened by those that are already well respected in the community. The first advertising burst lacking ongoing promotion makes the initiative look like another passing fad. However, continuous updates around upcoming courses and their significance in society assist community in understanding that online learning is an essential part of the community's learning culture. Once online learning gets popular, society will want to be part of the masses.

- **Make learning a management directive.** It is basic to have upper-level administration bolster internet learning as a vehicle for proficient improvement in TVETs. Get administrators to record short introductions to welcome learners and urge them to take an interest in the online activity. Once the potential members realize that the administration is behind the movement, they become more willing to join.

- **Offer prizes and appreciation.** It feels awesome to answer an inquiry accurately, and to get input from lecturers and companions. Learners frequently do not anticipate uplifting feedback from online courses. Discover

ways to reward good performance of online students. Give completion testimonies and distribute a standard report containing the names of individuals who have effectively completed courses. Connect web-based learning projects to the executive administration process, making it unmistakable to members that the time they spend partaking in online projects is perceived as adding to their professional improvement.

- **Announce success stories.** Finding and distributing examples of overcoming hardship regarding web-based learning in TVETs is one method to encourage new learners that they too can be engaged in a successful learning on the web. Utilize the victories to complement promotion work.

- **Safeguard individual achievement.** Offer students the chance to be successful and they will return! Do the best to make compelling web-based learning conditions, providing solid emotionally supportive networks. More importantly, give early recognition and primary support for the online activity.

In this study we evaluate and validate the abovementioned motivations by Jennifer Hofmann to discover those that are applicable to TVET colleges and to make recommendations on strategies to be used for implementation.

1.10.3. The state of existing e-learning frameworks

We agree with (Asmal, 2003) when he states that the globe undergoes change, and information and communication technology (ICT) is key to this change. Electronic means of communication have transformed the information society. Improvements in ICT have radically transformed the teaching and learning process and have introduced new learning opportunities and access to learning resources beyond those traditionally accessible.

The Department of Education (DoE, 2003) indicates that the setting up of a telecommunication infrastructure offered for teaching and learning is slowly growing, but few colleges take advantage of the gains of ICT to improve the value of teaching.

The presentation of ICT to colleges provides new opportunities for students and lecturers to take part in innovative means of information selection, collecting, arranging and scrutiny. Furthermore, ICT presents the possibility of improving the management and administration capability of TVET colleges. The facilities offered by the initiative improve learning and deliver limitless prospects for both individual and collective growth. Currently provinces are at diverse stages of ICT incorporation in education. Substantial improvement has been made with a provincial execution in the Gauteng (Gauteng OnLine), Western Cape (Khanya) and Northern Cape (Connectivity Project). In over the last five years parastatals, Government, private sector and nongovernmental institutions have reacted well to the concern raised regarding addressing the inequality of access to technology. Such initiatives relate to connectivity, infrastructure, electronic content resources and ICT professional development all over the country including rural areas.

In spite of the abovementioned developments to improve access to technology and internet connectivity in South African colleges, there is still no e-learning framework in public colleges to facilitate KS and CoP. The framework that would serve as an alternative or supplementary platform to students who cannot make it to the college and enable them to obtain support in their own time, pace and geographic location. This study investigated the suitability of e-learning as a mechanism to overcome challenges faced by TVET colleges with regard to KS so as to benefit the student and generations to come.

1.10.4. E-learning critical success factors

We would like to agree with (VirtualCollege, 2012) when they state that in the good old days e-learning got a terrible press. Some individuals thought that bringing PCs into the classroom would replace the human component that various students require. Yet as time has advanced, innovation has improved, and cell phones and tablets are common in classroom and office. This makes learning pleasing for the students, as well as significant as a lesson transmission medium.

We agree with (Odunaike, Olugbara, & Ojo, 2013) that it is important for us to guarantee that the work of enhancing graduation and achievement rates through the

execution of e-learning is not lost. ICT ventures have failed for many reasons including poor planning and human blunders (Christensen, 2000; Kim & Bonk, 2006). Adoption of e-learning is a major venture. Several writers, particularly (Bonk, 2001; Ross, 2000; Colbrunn & Van Tiem, 2000) state that the key reasonable starting point for executing e-learning is to evaluate readiness. This can be achieved by measuring the institution's readiness, assessing and recognising the organisational objectives, motivation, constraints and resources. We strongly agree that readiness assessment should be done otherwise the proposed study would be incomplete without providing a guideline on how TVETs can get themselves ready for e-learning as a mechanism to overcome challenges faced by TVET with regard to KS. The focus was on proper monitoring and assessment of e-learning implementation readiness under the following headings: adequate planning for e-learning readiness, training, sustainability plans, e-learning collaboration, adoption of best practices, and maximisation of learning management system (LMS) usage. Furthermore, we instructed management to take a lead by conducting preliminary assessment of sustainability readiness (Odunaike & Dehinbo, 2009; Sultana, 2014; Suhail & Mugisa, 2009).

1.11. Conclusion

This chapter offers an overview of the entire study. The chapter started by informing the reader about its intention, proceeded by providing the research background and motivation so that the reader can understand the importance of this study. This chapter set the scene with regard to the main problem being addressed in this dissertation which is that of availing the body of knowledge with an e-learning framework aiming at resolving current shortcomings of TVET colleges on KS and therefore education. The problem statement, and research objectives and research questions were communicated. The methodology used to answer the research questions was discussed. The research outcomes, scope and limitations were presented.

A preliminary literature review on key concepts such as KS in TVET colleges, the culture for effective KS, the state of an existing e-learning framework and e-learning

critical success factors was presented. The next chapter seeks to answer the first research question on the state of the art of KS in TVET colleges.

2. Knowledge Sharing in TVET Colleges

2.1. Introduction

The main objective of this chapter is to explore the literature in order to grasp an understanding on the state-of-the-art of knowledge sharing in TVET colleges. Thereby respond to research question 1 which is “What is the state-of-the-art of KS in TVET colleges?”

The answering of the first research question gives the reader an idea of what the norm is in TVETs regarding KS which then guides the entire dissertation. As the current norm is exposed, challenges associated with it are also revealed. The challenges identified inspired the direction of the study as it strives to provide solutions to existing challenges associated with KS.

The chapter starts by providing a comprehensive definition of TVET, offers details on the courses offered and the differences between university and TVET. The chapter further explores knowledge, knowledge types, knowledge management, KM frameworks and models, KS, importance of KS, KS models, barriers to KS and finally raise the limitations from previous studies with regards to KS.

2.2. Definition of TVET

TVET is the acronym for Technical Vocational Education and Training (fetolleges.co.za, 2012). UNESCO defines TVET as the educational process that involves the attainment of practical expertise, understanding, attitudes and knowledge associated with the profession in a number of areas of the economy within a country. UNESCO further states that TVETs gets students ready for industry not only with vocational skills but with a wide-range of skills, knowledge, attitudes and values that are renowned as key to a fruitful contribution in work and life, today. The gains to the learner include improved self-esteem and self-awareness, communication, citizenship, interpersonal and entrepreneurial skills.

(fetolleges.co.za, 2012), declares that the South African education system is directed by the Department of Basic Education (DBE) and the Department of Higher Education and Training (DHET). The DBE directs school education from Grade R to Grade 12 while The DHET directs post-school education and training. (ParliamentSA, 2013) indicates that the post-school system comprises public TVET colleges (formerly called FET colleges), public universities, public adult learning centres, private TVET colleges (previously called FET colleges), National Skills Fund (NSF), Sector Education and Training Authorities (SETAs) and the controlling bodies responsible for qualifications and quality assurance in the post-school system which are the South African Qualifications Authority (SAQA) and Quality Councils. TVET colleges offer the vocational, occupational and artisan education and training.

2.2.1. Vocational education

(Dictionary.com, 2012), defines vocational education as an educational training that offers hands-on experience in a specific trade, craft, skill, or in support roles in careers like business management, engineering, financial management, hospitality and catering, or management assistant. Normally, craft vocations are based on hands-on activities and are by tradition non-academic yet linked to a particular occupational field. Vocational education is also called career education or technical education (Aste, 2015). Internationally, especially in European countries such as United Kingdom and Germany, vocational education takes place at secondary/high schools, post-school institutions such as community colleges, institutes of technology/polytechnic and universities; and can work together with the apprenticeship system. At the post-school level, vocational education is frequently delivered by highly skilled community colleges, universities of technology and universities (Wolf, 2002).

(OECD, 2008), reports that in Norway learners who leave lower secondary school enter upper secondary education, and about 50% pursue one of nine vocational programmes. These programmes are delivered using a normal model for upper secondary Vocational Education and Training (VET) which is usually called 2 + 2 system, which refers to two years in school followed by two more years of

apprenticeship in a company. The first year in upper secondary VET offers general education and preparatory knowledge of the vocational area. In the second year of study, the courses become more trade-specific. The apprenticeship occurs with a manager (or managers) and focuses on a national curriculum. The apprentices obtain a remuneration ranging from 30% to 80% of the wage of a qualified worker, with the pay increasing over the apprenticeship period. Companies accepting apprentices get subsidies from the county which covers two years of the apprenticeship, similar to the cost of one year in school per apprentice/trainee (OECD, 2008).

2.2.2. Occupational education

Occupational education is defined by (Gail, 1966) as a work-oriented education. It is good for occupational education to start from the foundation school with a fundamental introduction to the place of work in a fashion that is suitable for the work readiness of learners. He further recommends that this kind of education should continue through the intermediate school years, with proper standard to make sure that students cultivate good attitudes and values required for work.

(WashingtonStateLegislature, 2012), states that occupational education credits arise as an outcome after a number of learning engagements intended to help the student obtain and show competence in the required skills for the appropriate occupation. (Bisol, 2016), indicates that for quite a long time the US government has utilised occupational education as an answer to an on-going problem in which the country lacks individuals who are technically oriented. He advises that occupational education is an advanced option within the sphere of education as it delivers an acceptable role in teaching students who choose and are chosen depending on their capabilities through difficult, multi-faceted assessment, to pursue a career that needs dedicated groundwork.

In California, approximately all post-secondary teaching positions assist graduates to obtain values and skills that permit them to make an income. The professional and technical education educators are suitable for intermediate and high schools'

occupational education jobs in which they normally work school hours ranging from 08:00 to 15:00. The teaching professionals usually focus on a specific occupation like mechanics, agriculture or carpentry. These professionals impart occupational skills to students and observe student performance. They make connections with local industries for graduates to obtain internships and apprenticeships. The educational requirement of the career education teacher is to possess a bachelor's degree in teaching coupled with a degree in the subject they teach for example graphic design and sufficient industry experience for them to offer firm education regarding workplaces. This is similar to what is taking place in South African TVETs as they are also offering skills to student, work school hours, make contact with local industries to improve students' placement and require both professional and technical qualifications for one to be employed as a lecturer. Professional qualification refers to the teaching qualification while technical qualification refers to the field of specialization such as public management (Locsin, 2008).

2.2.3. Artisan education

Artisan education refers to training offered to produce an artisan. An artisan is someone who makes things in a traditional way by hand – for example, a chef is an artisan specialising in cooking (dictionary.cambridge.org, 2009). Artisans exercise a skill and through experience and fitness they excel and eventually reach the high levels of an artist. In South Africa, seven steps need to be followed in order to become a qualified artisan. The seven steps (in sequence) are: career guidance and management, general or vocational or fundamental knowledge learning, learner agreement registration and contracting, occupational knowledge and practical learning, workplace learning, trade testing and recognition of prior learning and the final step is assurance and certification (nadsc.dhet.gov.za, 2014).

The DHET has recognised as a priority the need for competent artisans in every field to enhance industry and improve economic growth within South Africa. The country is now generating an average of 13 000 qualified crafts worker per year which is below 50% of the 30 000 artisans that the country is supposed to generate annually by 2030. For significant growth to be realised, the country needs financial stability and continued dedication by all artisan development role players in South Africa.

The Ministry of Higher Education and Training declared year 2013 as the “Year of the Artisan Programme”. The “Year of the Artisan” events promoted the profile of craft workers and it was decided to carry on with an extended encouragement programme that would be recognised as “2014 – 2024 Decade of the Artisan”. The purpose of the programme is to recommend artisanship as an occupation of choice among the upcoming youth as part of the national strategy to deal with the shortage of critical skills (nadsc.dhet.gov.za, 2014).

2.3. TVET colleges versus universities

TVET colleges mostly accommodate learners who desire to embark on vocational training regardless of whether they have completed their early schooling or not. Universities only accommodate learners who are in possession of grade 12 (matric) and not just simple matric passed; universities are known for enrolling the best performing students by means of a point system. The purpose of TVET is mainly providing educational training to their own communities in order to grow relevant skills aimed at servicing local industry. TVET colleges should continuously strive to be the best in supplying skills that help communities eradicate poverty and meet their ethnic and societal needs; by so doing TVETs will gain the approval of individuals and the community at large. The white paper on post-school education states clearly that TVET colleges are fundamental to the delivery of post-school teaching and learning. It is the portion targeted by DHET intended for growth and variety. At present, in spite of substantial growth, TVETs continue to enrol smaller number of students compared to universities. TVET colleges comprise two faculties which are Business Studies and Engineering Studies while universities have many such as Commerce, Health, Law, Computing, Science, Engineering, Education, and Humanities.

The significant difference between TVET colleges and universities is that South African TVET colleges offer two qualifications, namely, Report 191 previously known as National Accredited Technical Diploma (NATED), and National Certificate Vocational (NCV). The NCV qualification offers level 2 to level 4. The duration of each level is 1-year for both Business and Engineering studies. Level 2 is equivalent

to grade 10, and grade 9 is an entry requirement to level 2 while level 4 is equivalent to grade 12. Report 191 courses offer N1 to N6 coupled with 18-months internship and upon successful completion a student obtains a National Diploma. For Business Studies the duration of each level is 6 months, that is, 1-semester and 3 months for Engineering Studies, that is, 1-trimester. The N1 level is equivalent to grade 10 and grade 9 is an entry requirement to N1 while N3 is equivalent to grade 12; making N3, grade 12 or NCV level 4 an entry requirement for N4 (DHET, 2013; NCOPEducationandRecreation, 2015).

The university is an organisation that delivers both undergraduate education and postgraduate education. The term university is taken from the Latin phrase "*universitas magistrorum et scholarium*" which means "the community of teachers and scholars". The recent use of the term university refers to "institution of higher education" which predominantly provides non-vocational instruction. The universities have the authority to offer degrees. What distinguishes universities from colleges is that universities are organisations of research that offer academic degrees in a number of subjects. The undergraduate qualifications consist of higher certificates, diplomas and bachelor's degrees while the postgraduate qualifications consist of postgraduate diplomas, honours degrees, masters degrees and doctorate degrees (sastudy.co.za, 2010).

Knowledge sharing is a form of knowledge dissemination and transmission to students in the context of TVET. Therefore, when referring to learning in this section, we are referring to knowledge dissemination/transmission to students. The traditional form of KS with students has always been face-to-face. Face-to-face refers to the fact that students sit in a classroom with lecturers disseminating knowledge to them in the form of a lecture/lesson. The challenges include limited access to TVET colleges as universities continue to enrol more students compared to TVETs due to infrastructure (DHET, 2013), lecturers' and students' failure to attend classes leading to poor performance (DHET, 2011), and no means of communication beyond the classroom.

With the current digital era, most of the things are performed virtually. Post is sent via electronic mail, and phone calls may include videos via the internet. Today, more

and more individuals work remotely from the comfort of their home. It is quite difficult for many to imagine communication without technology, particularly the internet (Banna, 2014; Lewin, 2013; Barton, 2011; Barton, 2012). Hence, this study is being conducted to allow the use of technology to overcome existing KS limitations in TVET colleges.

2.4. An overview of knowledge management

According to (Girard & Girard, 2015), knowledge management (KM) in education entails obtaining, remembering, storing, sharing and communicating knowledge in educational institutions by means of both the latest technologies and traditional means of communication. Knowledge management was founded in 1991 and comprises courses that belong to the field of commerce. In recent times, numerous fields such as information and media, computer science, public health, and public policy began to support research associated with KM. As a result, a number of universities are now offering dedicated degrees in knowledge management (Nonaka, 1991). A number of large organisations, public institutions and non-profit organisations have assets devoted to interior KM endeavours, frequently as a piece of their business methodology, data innovation, or human asset administration divisions. Few counselling organisations offer support and encouragement to these organisations regarding KM (Addicot, Rachael; McGivern, Gerry; Ferlie, Ewan, 2006; Maier, 2007).

It is an empowering agent of institutional learning. Knowledge management has been continuously growing academically from the moment it was formed (University of North Carolina, 2007). Firstly, cooperation has become a norm among academics such that there has been a significant reduction in single-authored publications (Bray, 2013). Secondly, the contribution of academics towards academic research has radically declined from 30% of overall contributions up to 2002, to only 10% by 2009 (Serenko, Alexander; Bontis, Nick; Booker, Lorne; Sadeddin, Khaled; Hardie, Timothy, 2010).

The intention is to make knowledge available to suitable individuals when necessary for the college to gain from decisions made by the knowledge-empowered individuals (The ABCs of Knowledge Management, 2004). How knowledge is managed relies on the mode of delivery used. Traditionally, education was based on attending classes, listening to lectures and appearing in exams (Albarrak, 2007).

2.4.1. Definition of knowledge

(OxfordDictionary, 2008), defines knowledge as the familiarity, awareness or understanding of a subject and further states that knowledge can include both practical and theoretical understanding of someone or something; such as skills, information, facts or descriptions, obtained from education or experience by recognising, ascertaining, or learning. The types of knowledge consist of tacit knowledge and explicit knowledge.

2.4.2. Types of knowledge

2.4.2.1. Tacit knowledge

(Chugh, 2015), describes tacit knowledge as that type of knowledge which cannot be expressed or transferred in writing or out loud from the sender to the recipient, and can be summarised as “we can know more than we can tell”. He further, says that tacit knowledge can be referred to as ideas, skills and experiences that people possess in their minds which are difficult to access as they are often not organised and may not be easily uttered. Usually people who possess tacit knowledge are not conscious of the knowledge they have and how to make it meaningful to others. Adequate transmission of tacit knowledge usually needs extensive personal contact, consistent communication and trust. Once the knowledge owner connects to a network or a community of practice, the transfer of knowledge is enhanced. This type of knowledge can be exposed through practice in a specific setting and communicated through social networks (Goffin & Koners, 2011). In traditional learning this type of knowledge can be transferred from lecturer to students through practical activities as it is fairly difficult to express it in writing or out loud. In general, TVET encourages practical learning which is learning by doing in order to obtain

skill(s) and the required values for getting students ready for work. With online learning tacit knowledge can be transmitted from the lecturer to students through videos and tutorials showing how to perform task(s). These activities or tasks must be in line with the curriculum. The curriculum helps the lecturer or tutor to have an idea of the required knowledge as it is difficult for an individual who possess this knowledge to be conscious of it, organise it and make it meaningful to others; the curriculum helps with this. By means of online learning, videos and tutorials can be kept permanently, and students can download them into their storage devices for future use which is not the case with real-time traditional learning modes (Aste, 2015).

2.4.2.2. Explicit knowledge

Explicit knowledge is referred to as knowledge that can be easily expressed and transferred in writing or spoken aloud as opposed to tacit knowledge; as a result it can be easily communicated to recipients. In most instances explicit knowledge is in the form of instruction booklets, official papers, procedures, product design, audio, and videos where human skills, intentions and knowledge are conveyed (Helie & Sun, 2010). In TVETs, explicit knowledge can be regarded as knowledge acquired by students through formal classes and prescribed textbooks. With the traditional setup being the most dominant mode of learning in TVETs, the knowledge is transferred from the lecturer to students through spoken words which are impermanent as opposed to online learning where knowledge is usually transferred from the lecturer to students through writing via online discussions or chats which are permanent (McConnell, 2000).

2.4.3. Knowledge management (KM)

Knowledge management (KM) refers to an idea where the organisation deliberately and widely collects, organises, shares, and analyses its knowledge in relation to people skills, documents, and resources. Previously few organisations really had a complete knowledge management practice setup. The improvements in technology which changed the way people access and exchange information has led to several organisations that are now having some kind of knowledge management framework

in place (Rouse, 2013; Wiig, 1993). (University of North Carolina, 2007), describes KM as a multi-disciplinary tactic to accomplishing institutional objectives by ensuring the best utilisation of knowledge. Knowledge management takes account of courses taught in the arenas of business management, information sciences, information systems, library and management (William, 2012).

(Kumar, 2015), states that the discipline that can probably achieve the most from engaging in KM is education, whose main purpose is to deliver knowledge. Higher educational institutions have substantial chances of making use of KM activities to assist all parts of their operation. Knowledge management ethics is aware that it is essential for institutions to be aware of what they know. All educational institutions fundamentally store, access and provide knowledge in a certain fashion but the value of knowledge being delivered through products and services cannot be easily measured. He further adds that the role of an institution of the present information culture calls for a new strategic outlook into KM and formation of the KM systems for institutions of higher education. According to (Hollander & Yee-Mar, 2009), South African TVETs aim to function as transformed, responsive and high-quality systems. The government uses this system to support the combination of education and training, as well as the enrichment of learner mobility and progression, to ensure human resource needs are satisfied. The main objective of TVETs is to meet these needs to promote economic, civic, personal and social development within the country. The mission of TVETs is to empower students with intermediary to advanced skills that facilitates the switch from school to work and develop independent life-long learners.

2.4.3.1. Knowledge management frameworks

In the previous section, the definition of KM was explored. This section focuses on knowledge management frameworks and later on knowledge management models. (Mostert & Snyman, 2007), defines ‘knowledge management framework’ as an actual or theoretical organisation planned to work as a backup or director for the construction of a KM system that grows the system into a valuable structure. The author further states that in computer systems a framework is usually a layered arrangement demonstrating the types of packages that can or should be made and

also show how they should link up with each other (TechTarget, 2013). Certain computer system frameworks might as well include real programs, lay down program writing interfaces, or provide programming instruments to be used for a specified framework. KM frameworks are made up of four basic components which are people, KM processes, KM technologies and KM governance.

People: play a lot of roles at different levels to management knowledge and for that reason they are the most important component. People carry out various tasks and contribute different input at a number of levels in a knowledge management system (KMS). It is people who must design a KMS to offer correct information, at the preferred time, to employees and management to implement the information for the benefit of the institution.

KM processes: a number of reliable processes exist in KM for capturing, filtering, validating, storing, applying, recycling, and transforming knowledge.

KM technologies: the persons together with the procedures needed to allow knowledge to be tracked and accessible wherever it may be kept in databases, intranet and people's minds. IT plays a vital role in KM through making technology available to allow communication among people.

KM governance: in the absence of a control system that supports sharing and the re-use of knowledge, any efforts to bring together KM can hardly produce the desired results (Knoco, 2011). The focus of the sub-sections below is on broad frameworks for knowledge management which are framework of core capabilities and knowledge building, framework of knowledge management, framework of knowledge management stages, framework of the knowing organization.

2.4.3.2. Framework of knowledge management pillars

Wiig's KM framework comprises three KM pillars. The three pillars signify the most important roles necessary to manage knowledge. Figure 2.4.3.2 shows the pillars of KM as demonstrated by Wiig.

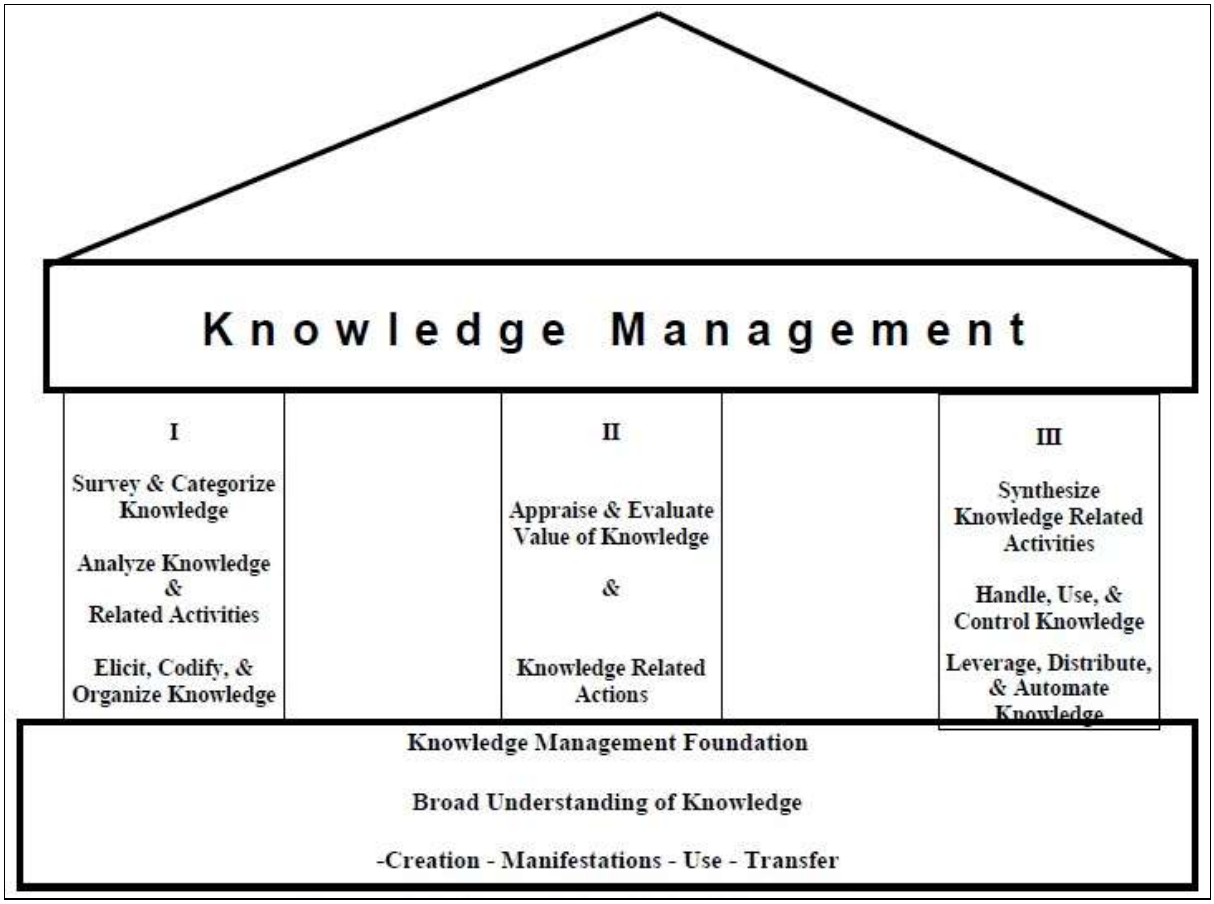

Figure 2.4.3.2: Pillars of knowledge management (Sivasubramanian, 2016)

These pillars are founded on a comprehensive understanding of knowledge creation, use, manifestations, and transfer. The focus of **Pillar I** is on discovering knowledge together with its suitability. As a result thereof, this framework performs a number of functions which are survey and categorise knowledge; analyse knowledge and knowledge-related events; stimulate, collect, and organise knowledge. **Pillar II** involves appraising and assessing the worth of knowledge and knowledge associated events. The last pillar which is **Pillar III** performs the following functions, namely: produce knowledge associated events; use, handle, and control knowledge; and automate, leverage, and distribute knowledge (Sivasubramanian, 2016).

2.4.3.3. Framework of core capabilities and knowledge building

This KM framework consists of four essential capabilities together with four knowledge building events. (Barnes, 2002), stresses that these are fundamental aspects of a knowledge-based organisation (KBO).

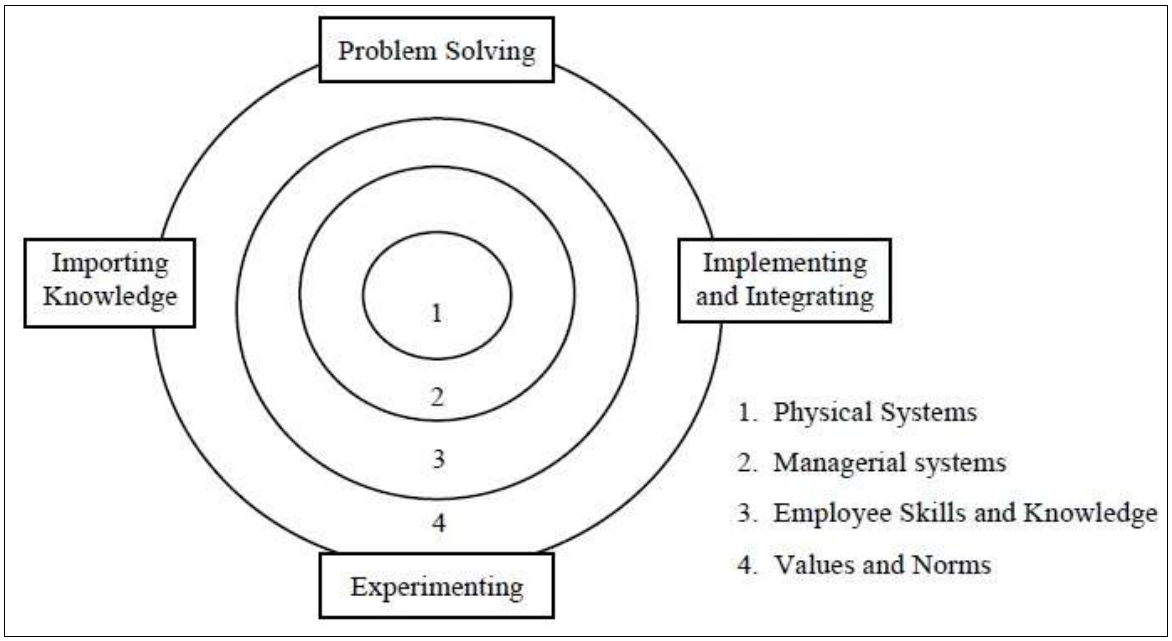

Figure 2.4.3.3: Core capabilities and knowledge building activities (Barnes, 2002)

Figure 2.4.3.3 illustrates the four knowledge-building events which are around the fundamental capabilities: **problem solving** to support the production of existing products; **implementing and integrating** new procedures and instruments to improve interior processes; **experimenting** in order to develop competencies needed for the upcoming system; and **importing knowledge** to help in bringing equipment or expertise from the outside of the institution's knowledge. The knowledge-development operations require capable individuals and systems. The core capabilities comprise the competitive advantage of an institution which have been developed for a long period and may not be copied easily. The four core capabilities acknowledged in this framework are **physical systems** abilities grouped in substantial systems constructed for quite a long while such as software, machinery and databases; **managerial systems** consisting of structured procedures guiding assets gathering and deployment generating the networks over which knowledge is regained and moves; **employee skills and knowledge** which contribute positively to the formation and maintenance of the knowledge system; and the institution's **values and norms** which provide support in recognising the types of knowledge that are essential and valued, together with the range of knowledge-building operations recognised and supported within an organisation (Barnes, 2002).

2.4.3.4. Framework of the knowing organisation

This framework as shown in Figure 2.4.3.4 suggests that an institution utilises information cleverly for common sense making, decision making, and knowledge creation.

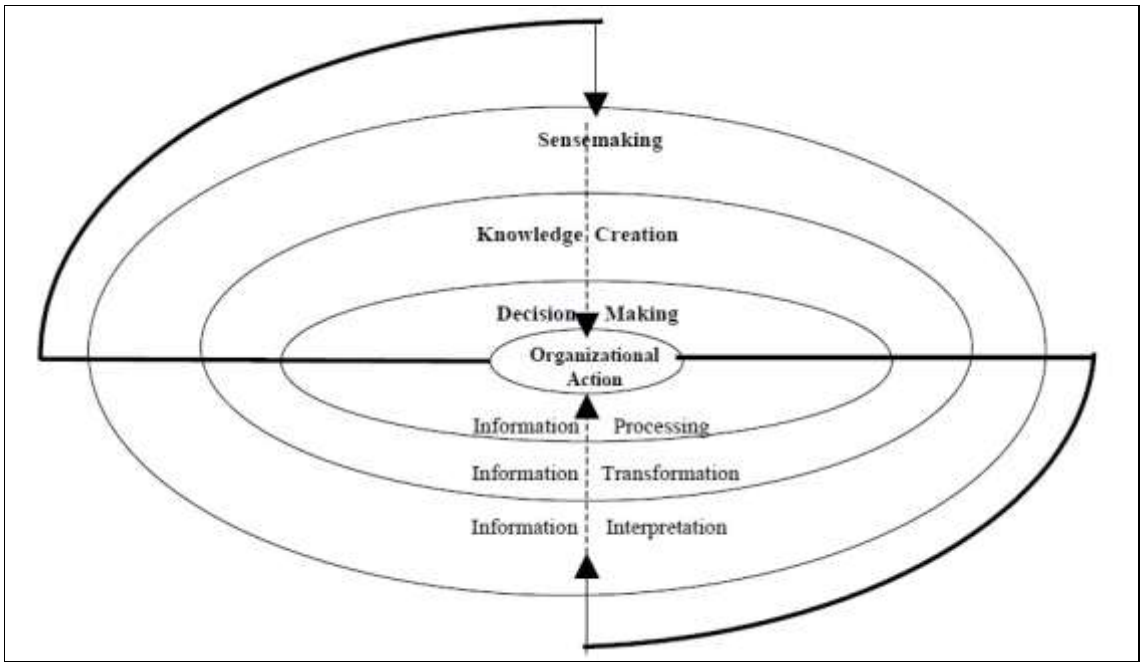

Figure 2.4.3.4: Framework of the knowing organisation (Choo, 2006)

The three practices are related to each other to form a series of linked information activities that describe a business that owns the knowledge and information to work wisely. This framework does not differentiate between the words 'information' and 'knowledge' when using them. Throughout the **sense making** practice, an institution makes every effort to understand its changing situation. The practice worries about how people within an institution understand information in order to survive in the context of environmental insecurity. While busy with **knowledge creation** practice, an institution generates new knowledge for the sake of improvement. This practice focuses on how information is converted into fresh knowledge within an institution. This framework looks at **decision making** as a practice concerned about understanding exactly how an institution uses information to enhance performance (Choo, 2006).

2.4.3.5. Framework of knowledge management stages

This framework which was developed by (van der Spek & Spijkervet, 2009) recognises four knowledge management stages which are retrospect, act, reflect, and conceptualise.

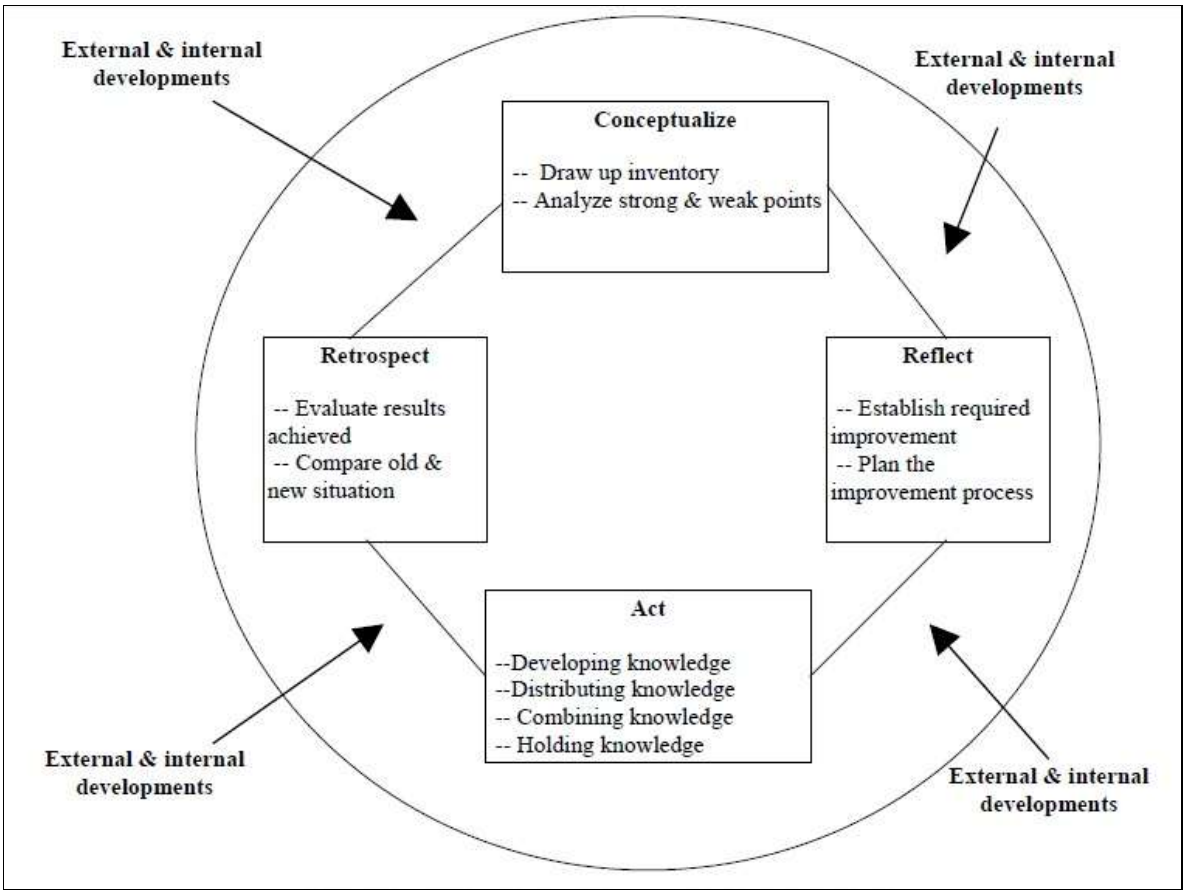

Figure 2.4.3.5: A framework of knowledge management (van der Spek & Spijkervet, 2009)

Figure 2.4.3.5 demonstrates that these stages control the basic processes of knowledge. The **Conceptualise** stage concentrates on obtaining understanding of knowledge assets. It is accomplished by means of investigating, categorising, and demonstrating current knowledge. In the **Reflect** stage, abstract knowledge is assessed by means of a number of conditions such as the required improvements and the planned improvement procedures. In the **Act** stage, actions to advance knowledge are considered. The actions include formation of new knowledge plus allocating, uniting, and keeping the newly developed knowledge. During the final

stage, which is **Retrospect**, the outcomes of the act stage are identified and assessed and the past and new circumstances are compared. The framework of KM stages is concerned with problem-solving. Such a framework can be perceived as a way of synchronising knowledge management actions with problem-solving methods.

2.4.4. Knowledge management models

(BusinessDictionary, 2009), describes a model as a simplified version of a concept, demonstration, connectivity, arrangement, system, or a feature of the real world. Its objectives include:

a) To facilitate an understanding of the proposed system by excluding components that are not important;
b) To help with decision-making by allowing the imitation of varies scenarios; and
c) To control, explain and predict activities based-on past observations.

Usually a number of entities and occurrences are quite complicated consisting of many components and very complex, where components have a lot of interconnections and need to be understood in their completeness. A model should then consist of only those features that are most important in fulfilling its purpose.

2.4.4.1. The knowledge management model of Botha, Kourie and Snyman

This model aims to provide a real indication of the KM process. The tactical focus of this model is on the "when" and the "why" (see Figure 2.4.4.1).

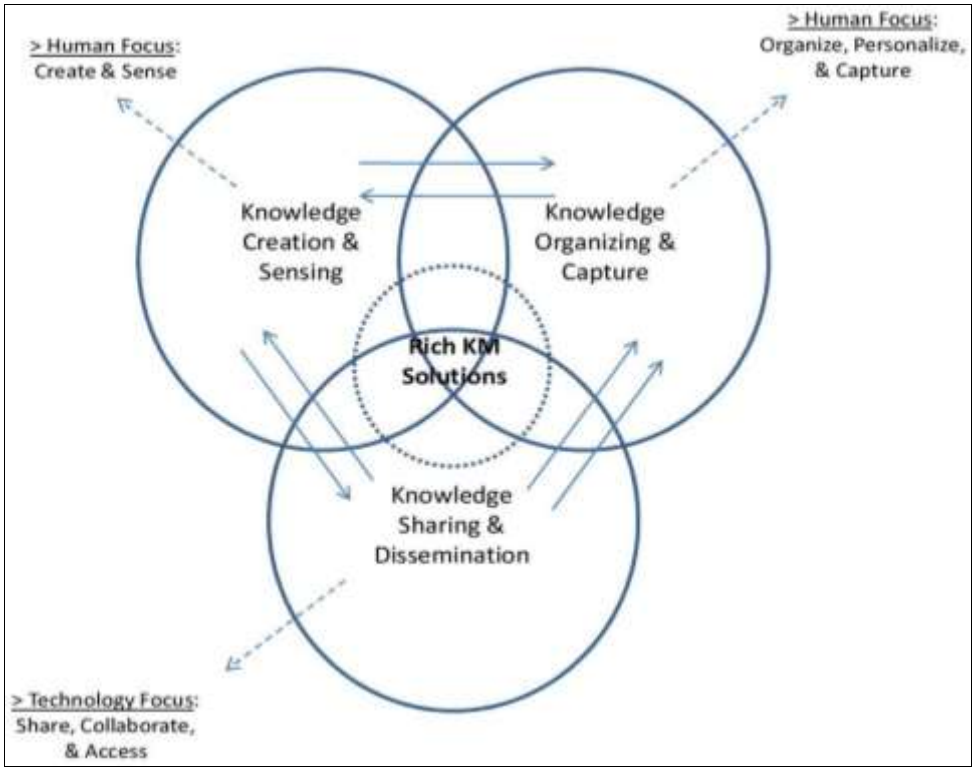

Figure 2.4.4.1: The knowledge management model (Botha, Kourie, & Snyman, 2008)

This model embraces the formation of new knowledge as a result of KM inspiration. This model also demonstrates which of the three classifications are more focused on persons and which are concerned with technology. It is open for discussion whether KS should mostly be technology motivated or not. The reality is that most institutions approach this matter as a technological instead of an organisational and social encounter. (Botha, Kourie, & Snyman, 2008)**,** have focused on three models which consider very diverse tactics of KM. The three models do not deal with an important aspect of KM which is measurement of outcomes to help check if the KM system is accomplishing the desired results or not.

2.4.4.2. The knowledge management matrix of Gamble and Blackwell

The KM model in Figure 2.4.4.2 demonstrates a general abstract framework, together with the definite procedures for putting it into practice.

Type / Approach	Embodied	Represented	Embedded
Sense	Observe	Gather	Hypothesize
Organize	Contextualize	Categorize	Map
Socialize	Share	Disseminate	Simulate
Internalize	Apply, Decide, Act		

Figure 2.4.4.2: The KM matrix (Gamble & Blackwell, 2001)

The KM procedure is divided into four phases. Firstly, management needs to sense the sources of knowledge and they should then organise the knowledge to make it possible to evaluate the organisation's strong points and weaknesses and recognise its significance and re-usability. This is followed by socialisation, in which different procedures are applied to help distribute and spread knowledge to everyone who needs it in an institution. Finally, the knowledge is internalised through its application. Just like all models which follow a certain order, the stages are not supposed to be taken exactly, however they provide an indication of the responsibility of the KM manager. One critique of this particular model is its focus. Firstly, the general tactical role overview by Bukowitz & Williams (Doval, 2015) is not incorporated. Secondly, KM's role is restricted to KS, neglecting the procedures of knowledge attainment/formation and divestment. This is an excellent tactic to KM in which the emphasis is on the distribution and retrieval of current knowledge.

2.4.4.3. The knowledge management process of Bukowitz and Williams

Figure 2.4.4.3 illustrates the procedure that defines the plan of management to form/sustain, divest, and improve knowledge-based assets. This model stresses motives and time facets.

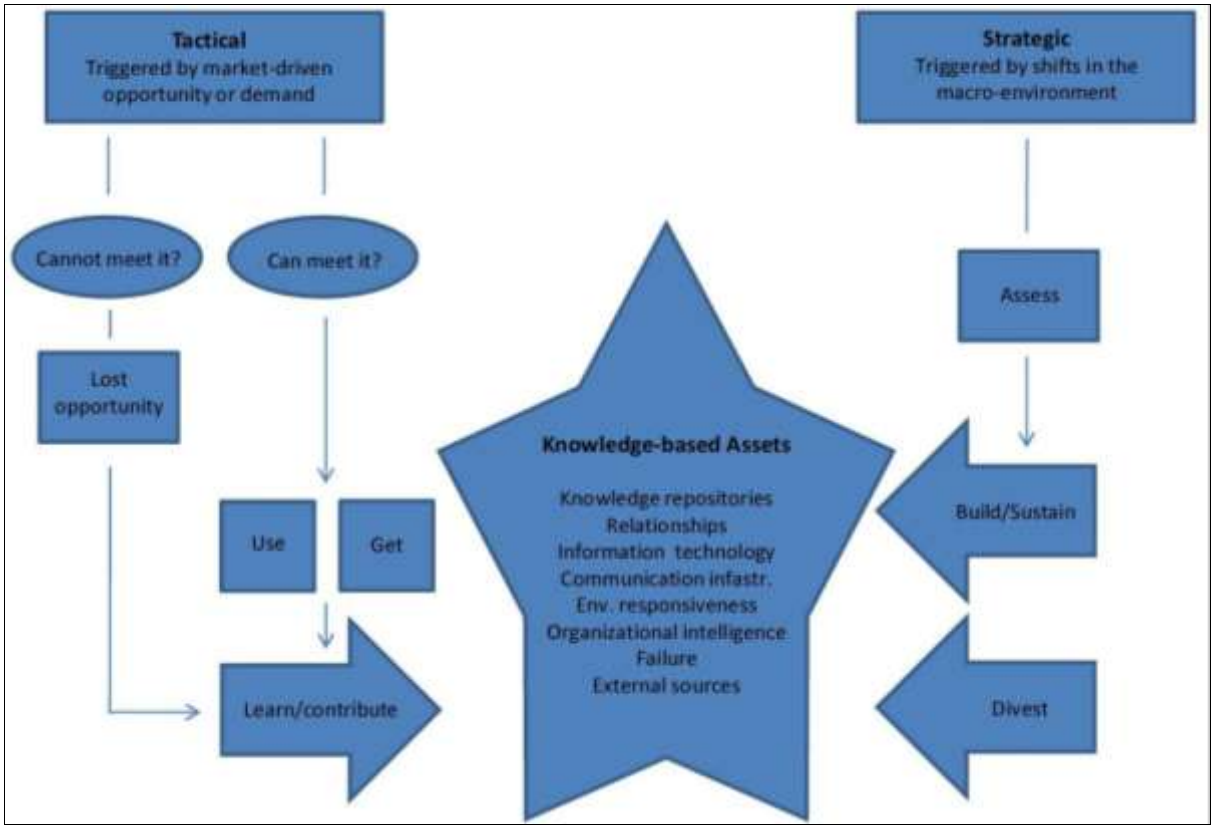

Figure 2.4.4.3: The KM process (Doval, 2015)

The benefits of this model come as a result of its tactical focus, which fundamentally places knowledge management operation into perspective. The idea of "divestment" is incorporated, and it is worth noticing as it is something that is frequently omitted from KM models. Knowledge management creativities are the outcomes of the reaction to planned and strategic changes and requirements. The model offers a good outline of the tactics behind KM.

2.4.4.4. The integrated knowledge management model

The integrated knowledge management model illustrated in Figure 2.4.4.4, produced by (Frost, 2012), gathers the key factors of the topics discussed in the model that emphasise a tactical outlook. The integrated knowledge management model tries to bond the procedure and plan, while providing certain initiatives at various phases. Furthermore, the model sketches the connection of information management systems and information to KM.

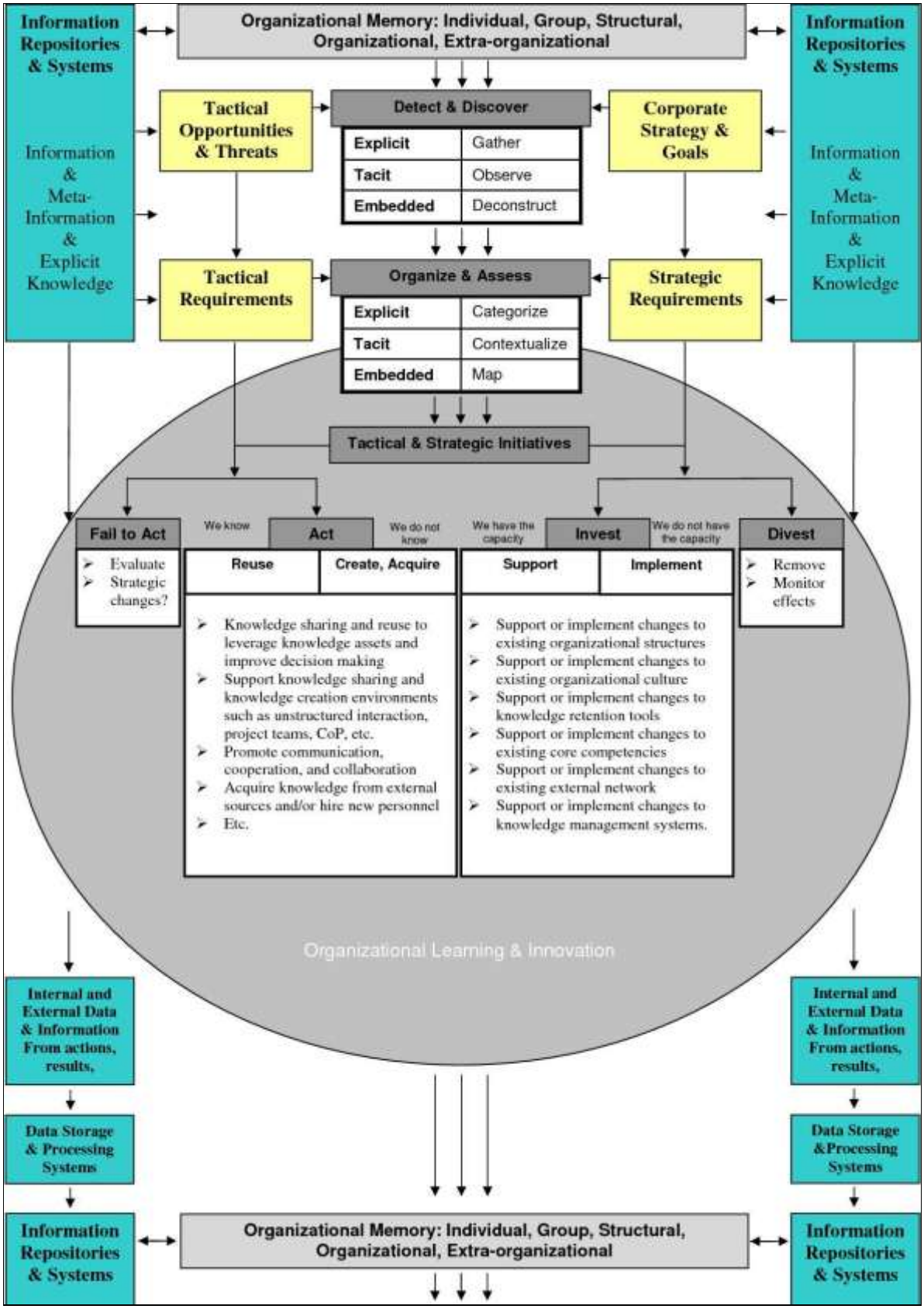

Figure 2.4.4.4: The integrated knowledge management model (Frost, 2012)

The integrated knowledge management model draws upon features offered by Bukowitz and Williams (Doval, 2015). It also includes the theory of organisational memory. The dark grey features symbolise KM creativities, the yellow boxes signify commercial strategy, and the teal boxes portray data and information systems and warehouses. The procedure is introduced from the tactical and strategic point of view, demonstrating the manner in which KM strategy relates to commercial tactics. The un-bolded components in the grey oval signify the knowledge associated procedures that take place within the institution while functioning, and which management improves through innovation. **Detect & Discover:** Discover the current knowledge together with the hidden knowledge contained by data and information. **Organise & Assess:** Arrange and evaluate knowledge resources. Knowledge is classified, valued, and easily accessed by making use of information representation tools such as diagrams, charts and any other suitable tool.

KM Tactical initiatives: **Act - Reuse:** In a case where an institution can apply current knowledge to deal with a strategic opportunity or risk, the role of KM would be to recognise this knowledge and allow it to be utilised. This implies that if it is needed by another individual/people, then KM would be liable for ensuring that such knowledge becomes accessible to every appropriate member. Knowledge recycle therefore associates the former scores on detection and organisation with a new feature, namely, KS. **Act - Create/acquire:** In the absence of the relevant knowledge resources, the institution can generate or obtain them, provided that proper procedures and arrangements are ready to enable this. For instance, knowledge can be obtained from associates in a case where healthy relationships exist. Knowledge formation may depend on the appropriate interior atmospheres which enable the mixture and transformation of knowledge resources. **Failure to act:** This is not part of the KM plan however, if it happens it may have negative consequences to the institution. In the incident where an institution fails to act, it can at least learn a lesson. The executive must assess the incident and make a plan on how to better address the situation to ensure that it is eliminated in the future and make it part of the continuous upcoming strategic plan.

KM Tactical Resourcefulness: **Invest:** Empower or execute. This refers to the institutional systems, culture, knowledge preservation, capabilities, external links,

and structures that directly, disturb, and/or support the KM initiatives for the extended period. Tactical initiatives may, for example, include generating a KS culture, reorganising the institution, forming helpful partnership, or employing a new IT system. With proper atmosphere and system, management can always sustain it. It is essential to remember that these do not only fall within KM and are all arenas of study in their own right. It focuses on the enhancement of KM in a long term. **Divest:** if knowledge resources get out-dated they should be removed. KM has the responsibility of sustaining appropriate knowledge resources.

The integrated knowledge management model itself is supposed to be perceived as an endless cycle that allows new or adjusted information and knowledge to be deposited into an institutional memory and information warehouses in an ongoing fashion. All procedures are as a result sustained by information systems. They perform a significant role in tracing development and offering the information into the system. In this fashion, every time the integrated knowledge management model is executed, it is grounded on various information, perceptions, knowledge, and situations than previously. Even if it is referred to as an "integrated" knowledge management model, the plan has never been for it to be all-embracing. Meanwhile KM is quite a far-reaching discipline and it is easy for one to keep on adding items to it up until the model gets too difficult to understand, which contradicts the intended purpose of the model and should be guarded against. Simplicity is the way to go (Frost, 2012).

2.5. Knowledge sharing

Knowledge sharing is described by Bukowitz and Williams (Doval, 2015) as the actions in which knowledge in the form of skills, information or expertise is exchanged among individuals, friends, families, societies, schools, colleges, universities or organisations. Institutions recognise that knowledge establishes a treasured intangible resource for building and nurturing competitive advantages (Miller & Shamsie, 2001). Knowledge management systems are largely used to support the undertakings of KS. Educational institutions are under increasing stress to be accountable from exterior and interior forces. Exterior forces include stakeholders such as businesses, state-owned organisations, and parents. Learning institutions are growing and the plea for facts regarding the results of student

learning is increasing. Internally, learning institutions are constantly pondering about accountability regarding how students' learning outcomes can be enhanced. Schools, colleges, and universities as institutions are dedicated to educational undertakings, and constantly seek to ensure that learners are studying by gaining knowledge in an effective and efficient manner (Petrides & Nodine, 2003).

Learning institutions should be able to show improvements in student learning and advancement. Therefore, learning institutions can find it useful to implement KM programmes to enhance their performance and results. For example, where one lecturer has knowledge on the improvement of students' learning results, if the college depends on this one expert to carry out continuous activities to enhance student learning results, it holds back the institution. The challenge is to transform the knowledge that is presently residing in one person and make it extensively and effortlessly accessible to other lecturers. For that reason, KM can be central to the enhancements of knowledge distribution for both explicit and tacit knowledge for the gain of the entire institution. Knowledge management in learning can be understood as being a framework or a method that empowers individuals within an institution to cultivate a set of methodical processes to gather information and distribute whatever they know which may include experiences, skills, values, beliefs and thoughts leading to improvement of services and results (Petrides & Nodine, 2003).

2.5.1. Importance of knowledge sharing

Knowledge sharing is supposed to be sustained by numerous social aspects (Yang, 2004) such as trust, care, emotional commitment and the quality of relationship.

Trust is the most significant aspect of KS. In the absence of trust, it is difficult for workers to share, join forces and communicate. The greater the level of trust among individuals, the greater are the chances of reaching honesty and success (Yang, 2004). The aim for any of the KS system is to allow the effective transmission of source knowledge from sender to receiver (Cummings & Teng., 2003). Knowledge sharing is also essential for institutions that are geographically isolated so that they are able to appreciate what they need to know in the bigger picture (Habtamu, 2011). Current research indicates that a lot of knowledge exists in any institution; some of it

is quite simple to organise but a lot of it is difficult to capture. Knowledge survives at various levels within an institution. (De Long & Fahey, 2000), have separated knowledge into three levels, namely, individual, group, and organisational levels. Knowledge is owned by an individual. Even if individuals establish a single level at which knowledge locates within institutions, the distribution of one's knowledge is important towards the formation, distribution, and management of knowledge at all levels within an institution.

(Nonaka & Takeuchi, 1995), were among the first researchers to acknowledge the significance of individual workers in the knowledge formation procedure. They also state that knowledge creation ought to be considered as a procedure in which knowledge possessed by individuals is improved and adopted as part of an institution's knowledge base. Thus, knowledge is generated by means of interaction among individuals at different levels within the institution. The authors make it clear that institutions are not capable of creating knowledge in the absence of persons.

2.5.2. Knowledge sharing models

The knowledge-sharing model is also named the tacit-explicit model (Nonaka & Takeuchi, 2009). Tacit knowledge refers to information that is owned by a worker and explicit knowledge is exposed or revealed knowledge. The transformation of knowledge from one kind to another happens often and usually brings the formation of new knowledge. **Explicit-explicit knowledge** transformation or combination is the re-alignment of explicit knowledge by means of arranging, adding, joining and classifying. **Explicit-tacit knowledge** transformation or internalisation occurs once one integrates knowledge learnt from knowledge objects. **Tacit-explicit knowledge** transformation or externalisation includes converting extremely personal knowledge to be known to others through either documentation or speaking. **Tacit-tacit knowledge** transformation or socialisation happens through distribution of experiences, functioning closely as a collective, and by means of continuous interchange of knowledge. Knowledge management along with KS systems ought to support all four kinds of knowledge transformation (Nonaka & von Krogh, 2009).

2.5.3. Barriers to knowledge sharing

(Sie, Aho, & Uden, 2014), state that knowledge distribution among learners is essential when studying. Learning and improvements occur as soon as students are co-operating and manage to distribute knowledge. For this reason, learners should be motivated and be prepared to share knowledge with one another. However, it is quite difficult to succeed in knowledge sharing because barriers may exist in the process. The barriers are listed under three categories which are individual, organisational and technological barriers (Dale, 2011).

2.5.3.1. Individual barriers to knowledge sharing

Individual barriers include: the shortage of time for KS and recognising individuals requiring knowledge; anxiety that sharing might compromise one's job security; failure to realise the worth and benefits that their knowledge might have for others; domination in sharing explicit over tacit knowledge; usage of strong chain of command, designation-based status, and official rule; scarce recording, assessment, reaction, communication, and acceptance of lessons learnt to improve both personal and group learning results; various experience ranks; less communication time between knowledge sources and recipients; inadequate communication skills; different age groups; different gender; lack of shared links; different educational ranks; thoughts of losing acknowledgement and approval from superiors and co-workers, thus making ownership of intellectual property important in order to know the rightful owner and give credit where it is due; no faith in others as they might abuse knowledge or gain unfair recognition; no faith in the correctness and reliability of knowledge because of it source

2.5.3.2. Organisational barriers to knowledge sharing

Organisational barriers include: poor integration of KM tactics and integration of these into the organisation's objectives and strategic approach; inadequate leadership and managerial guidance for presenting the advantages and importance of KS activities; insufficient platforms to share, reveal and produce fresh knowledge; no prizes and acknowledgement systems to encourage individuals to share their

knowledge; current commercial culture does not adequately promote KS activities; lack of organisational resources to offer suitable knowledge sharing opportunities; internal and external competition can be high; knowledge and communication flows are not flexible to support sharing as expected; workplace atmosphere and setup do not support KS activities; and business units are too big and difficult to control for the purpose of simplifying KS.

2.5.3.3. Technological barriers to knowledge sharing

The technological barriers are: absence of incorporation of IT systems and procedures which obstructs the manner in which individuals share knowledge; absence of technical support and instant repairs of incorporated IT systems disturbs work procedures and communication movements; impractical anticipation of workers' technological capacity; various IT systems not compatible with procedures; needs of the people incompatible with incorporated IT systems and procedures for KS activities; unwilling to make use of technological systems due to the lack of exposure to them; absence of training regarding workers getting used to new IT structures and procedures; absence of communication and presentation of the benefits of new systems as they are introduced compared to current ones.

2.6. Knowledge and learning

In sub section 2.4.1 knowledge has been defined as familiarity, awareness or understanding of a subject and further states that knowledge can include both practical and theoretical understanding of someone or something (such as skills, information, facts or descriptions) obtained from education or experience by recognising, ascertaining, or learning. Learning is the procedure for obtaining fresh knowledge or transforming current knowledge, actions, principles, skills, or favourites. Socially, learning commences prior to birth and proceeds until death. It happens as a consequence of continuous communication within an individual and between an individual and their surroundings (Gross, 2010). (Meyer, 2003), describes learning as a long-term transformation in an individual's knowledge or conduct as a result of experience. In educational institutions such as TVETs,

performance relies on the effective distribution of knowledge among stakeholders, that is, lecturer-to-lecturer in which lecturers share subject knowledge with each other as part of the lesson planning, and lecturer-to-students in which a lecturer shares subject knowledge with the students during a lesson. The effectiveness of learning is demonstrated by the students' success rate which includes attaining the qualification and students' ability to better serve the community or local industry for socio-economic development.

2.7. Limitations from previous studies

It is necessary to remember that knowledge turn out to be valuable not just only because of the information it carries, but also due to the engagement and capability to take the steps required to carry information. It is only through effective learning by the students that the educational institutions achieve optimal results in student success rates as demonstrated through course completion and graduates' ability to make a living. In TVET colleges, the traditional face-to-face mode of delivery is dominantly used. Knowledge is generally shared in a classroom in a particular period of time. Students and a lecturer need to be in an indicated venue during the specified period for the learning practice to take place which involves gaining knowledge from the lecturer, sharing thoughts and storing knowledge (Burgess, 2015). A number of limitations have been reported regarding the face-to-face mode of delivery, mainly shortage of time given for the event and restriction by geographic location. The students cannot interact with a lecturer outside the classroom. Thus, students with learning problems have no additional platform where they can improve their learning. This is also applicable to learners whose circumstances do not allow them to get to the college. As a result, quality education and students' success rate is compromised.

(VirtualCollege, 2012), states that the integration of learning with technology in the form of e-learning lets the students participate in the course whenever and wherever they are. The students can ensure disturbances to a hectic working plan are reduced. Students are at an advantage as they do not have to go to specific learning institutions, and they can catch up on training wherever they may be.

However, currently there are very few TVET colleges who are utilising an e-learning system. Hence the importance of undertaking a study on the formation of an e-learning framework for facilitating KS in TVET colleges is essential. Having such a framework could significantly contribute to resolving the various educational challenges faced by students and learners in these communities.

The research by (DHET, 2011), has also revealed that students and lecturers' absenteeism is one of the major causes of poor performance in TVET colleges. Lack of students' hostels contributes to causes of absenteeism together with lecturers' and students' unrest/strikes which negatively affect the formation of students' marks that requires their presence on the campus. The report clearly states that lecturers' absenteeism significantly affects students' attendance at lectures. Non-attendance by lecturers and students disturbs submission and incorporation of students' marks into the final advancement mark. As a result, the final mark becomes unavailable at the end of the trimester/semester/year.

The Norwegian school restructuring evidently stresses that the non-existence of a practice for sharing individual and collective knowledge can hinder colleges in their efforts to grow into specialised learning centres. Studies show that colleges have not yet employed a system for distribution of knowledge among lecturers, despite the fact that lecturers find the distribution of knowledge among lecturers to be a valuable source of learning (Molnar & Kelly, 2013; Little, Gearhart, Curry, & Kafka, 2003; Rismark, 2011). Research indicates that KS among lecturers is rare. The Norwegian school reform is clear on the need for KS. However, it is not that clear on how colleges should establish their everyday operations to incorporate activities for KS among lecturers for the advantage of students' learning. The TVET colleges remain without a platform for sharing knowledge among lecturers for skills enhancement (Collinson & Cook, 2013; Mawhinney, 2010).

In South African TVET colleges there is a lack of research particularly in the framework of technology enhancements applied to the concepts of knowledge, knowledge management and KS and therefore e-learning in TVETs. The foregoing justifies the relevance of this research. Schools, colleges, and universities as institutions dedicated to educational undertakings, constantly seek to ensure that

learners are studying by gaining knowledge in the most effective and efficient manner (Petrides & Nodine, 2003). For this reason, it is necessary for TVETs to investigate the learning mode that seeks to minimise or avoid the current existing challenges found with the dominantly used traditional face-to-face mode of delivery. Thus, we found it worth investigating e-learning for South African TVET colleges in particular, with the aim to build on its successful adoption at universities and some TVET institutions from other countries.

2.8. State of e-learning in South African TVET colleges

The literature indicates that currently, we have very few South African TVET colleges that are using e-learning as a means to educate students. Table 2.8-1and Figure 2.8 show modes of learning.

Province	Face-to-face	%	E-Learning	%	Total	%
KwaZulu Natal	8	16%	1	2%	9	18%
Gauteng	6	12%	2	4%	8	16%
Mpumalanga	2	4%	1	2%	3	6%
North West	3	6%	0	0%	3	6%
Eastern Cape	8	16%	0	0%	8	16%
Western Cape	4	8%	2	4%	6	12%
Limpopo	6	12%	1	2%	7	14%
Free State	4	8%	0	0%	4	8%
Northern Cape	2	4%	0	0%	2	4%
Total	**43**	**86%**	**07**	**14%**	**50**	**100%**

Table 2.8-1: Modes of learning in South African TVET colleges (DHET, 2018)

The table above indicates that 43 (86%) of the TVET colleges in South Africa do not use e-learning and only 7 (14%) have adopted e-learning, where the e-learning system is still at an infant stage. The technology is rarely being used by the students and lecturers which is due to the lack of support and awareness.

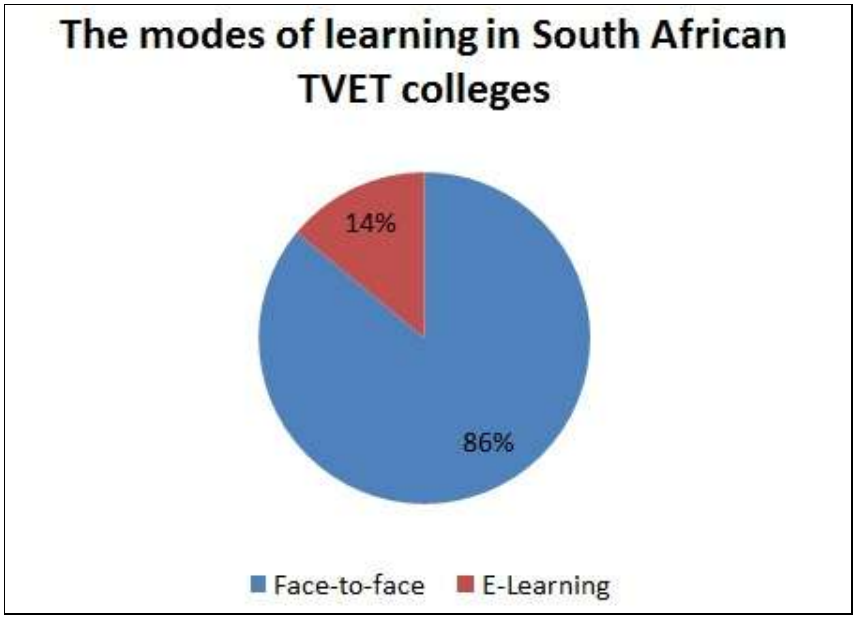

Figure 2.8: Modes of learning

These e-learning systems also lack key features and functionalities such as learning content and assessment activities, merely comprising discussion forums which are attended occasionally.

Want to adopt	%	Not sure	%	Do not want to adopt	%	Total	%
32	74%	5	12%	6	14%	43	100%

Table 2.8.-2: TVETs' intention to adopt e-learning (DHET, 2018)

The research shows that out of the 43 (86%) colleges who have not adopted e-learning, 32 (74%) want to adopt e-learning, 6 (14%) do not want to do so and 5 (12%) are unsure whether to adopt or not.

2.9. Conclusion

The intention of this chapter was to achieve sub-objective 1. It was achieved by answering the research question "What is the state-of-the-art of KS in TVET colleges?" The literature has been explored in order to understand the current state of KS in TVET colleges. The concepts of knowledge, knowledge management and knowledge sharing in relation to industry were encountered, but not much in relation

to TVET colleges. It is clear that South African TVET colleges are left behind on studies relating to knowledge, KS and knowledge management. For that reason, there has been significant need for this study to be conducted.

The focus is on technology enhanced KS which is in fact e-learning in the context of TVETs in South Africa. The literature explored showed that KS is practised in South African TVETs through traditional means which is face-to-face. The research indicates that of the 43 (86%) colleges who have not adopted e-learning, 32 (74%) of them want to take on e-learning, while 6 (14%) do not want to implement and 5 (12%) are undecided whether to implement or not. The e-learning systems are at an infant stage in all 7 (14%) TVETs who have adopted e-learning and requires development (as shown in table 2.8-1). This situation thus implies that the TVET sector remains behind when it comes to modernising their approach to knowledge sharing in order to overcome various challenges unpacked in previous sections. Developing a framework for implementing e-learning for TVETs, significantly contribute to the modernisation of education within TVETs and advance the value of learning and therefore contribute to the improvement of students' performance and participation.

Moving forward this dissertation focuses on finding how e-learning can be a substitute and/or supplementary mode of delivery suitable for TVET colleges in order to overcome existing barriers. The next chapter responds to sub-objective 2 by exploring the suitability of e-learning as a mechanism to overcome challenges faced by TVET with regard to KS.

3. E-learning as an Enabler for Knowledge Sharing in TVET colleges

3.1. Introduction

This chapter fulfils sub-objective 2 which is to investigate the suitability of e-learning as a mechanism to overcome challenges faced by TVETs with regard to KS. This is achieved by responding to the research question "How can e-learning be used to overcome the challenges currently faced by TVET colleges with regard to KS?" In the process, challenges faced by TVET colleges with regards to KS are addressed with the intention to find out how utilisation of e-learning can help conquer challenges.

The discovery of the impact technology can have in overcoming challenges associated with face-to-face learning helped contribute positively towards the formation of an e-learning framework. As a result, this chapter contributes greatly towards the fulfilment of the main objective of the study which is to develop an e-learning framework for facilitating KS and community of practice in TVET colleges.

The chapter begins by looking at the theories of education design, technology enhanced education, e-learning and the barriers to e-learning. The impact technology has on KS is enlightened. E-learning within the context of TVETs is explored. Furthermore, e-learning models are described together with the associated advantages and limitations of each.

3.2. Theories of education design

As previously described, KS is theorised as a procedure in which persons mutually give-and-take knowledge (both tacit and explicit) among each other to develop new knowledge. There are two fundamental performances of KS: *knowledge offering*, which is the source which makes a transfer to others, and *knowledge storing* which is the recipient who receives from others (Wabwezi, 2011). Education is a procedure for enabling learning, or the attainment of knowledge, expertise, ethics, beliefs, and

practices. Educational methods consist of storytelling, dialogue, instruction, exercise, and guided research. Usually, it occurs through the leadership of educators. However, students can also educate each other, either formally or informally. Every practice or action which has an influence on an individual's judgement, perception, or behaviour is educational (BusinessDictionary.com, 2013). Learning is the procedure for obtaining fresh or transforming current knowledge, actions, principles, skills, or favourites. The common component of KS, education and learning is knowledge dissemination in which students and lecturers share.

Diverse perspectives exist in educational theory that originate from various outlooks regarding the nature of education itself. (Greeno, Collins, & Resnick, 1996), describe three dimensions of learning:

a) Learning as an activity: focuses on learning by doing practical work in order to obtain the skill(s).
b) Learning for the intention of obtaining understanding: learning with the focus of gaining knowledge that can inspire a specific action.
c) Learning as a social practice: focuses on groups of students, defining action coordination where participants take part as members of social groups.

3.3. Technology enhanced education

The theory of education together with the various purposes of learning has been explained in section 3.2. It is therefore crucial to know how this learning is practised. The modern form of practising learning is through technology and for that reason the idea of e-learning is covered intensively in this chapter. The role of technology is mainly to engage distant students to a point where they can acquire knowledge as effectively as if they were campus-based, instead of providing a new teaching method. The improvement is reasonable instead of pedagogic as such, accomplishing affordable entry to learning, rather than being a new technique to accomplish profound knowledge of a theory.

Technology's educational worth can grow if it is exploited via an educational structure that incorporates its usage with quality assurance approaches. For this

reason it is essential not to under-estimate what e-learning is made up of, or what its key value may be (Mayes & de Freitas, 2004; Nelson, Courier & Joseph, 2011; OECD, 2010a). According to (UTAS, 2012; OECD, 2010b), pedagogy deals with the theory and practice of education and is therefore concerned about the study of how great students can be taught. (Biggs, 2006), refers to a good pedagogical design as being one which guarantees no gap between the *curriculum we demonstrate*, the *teaching methods we utilise*, the *learning atmosphere we select*, and the *assessment methods we implement*. For an institution to realise complete consistency, every assumption must be evaluated in every stage to ensure that everything leads to the desired outcomes. Thus, institutions should begin by cautiously determining the required learning outcomes, then select the learning and teaching activities that would let students attain the defined learning outcomes, and then design assessment activities that honestly assess if the objectives have been obtained. The procedure is quite simple to outline, but very challenging to implement.

In his report (Biggs, 2006) is more concerned about how design choices can be more effective by implementing the expectations of a constructivist pedagogical approach. This approach focuses on what the student is actually doing: assigning the teaching and learning activities (TLAs) at the core of the course. The overall intention of this report is to inspire experts and executives to make design decisions on e-learning in an ethical manner to expose the hidden expectations about the role of technology and proceed by asking the appropriate questions.

Individuals who are currently engaged in e-learning are mindful of the benefits e-learning can offer to an institution, and an individual. The benefits are listed in Table 3.4. (Ferriman, 2013). The flexibility of e-learning implies that it is possible to use it in daily life. Certain individuals pursue it to supplement learning opportunities and career improvements.

Benefit	Description
Scalable	Allows us to speedily produce and present new policies, ideas, training, and theories. Whether it is for fun or official learning, e-learning is lively!

Capacity and Consistency	Enables lecturers to obtain the best rate of coverage for the targeted number of students and allows the message to be communicated in a reliable manner. This ensures that every student receives the same training.
High Learning Retention	Mixed learning strategies lead to a greater knowledge retention rate. It allows assignments to be easily worked on and revised at any time necessary.
Time and Money Savings	E-learning decreases time spent away from the place of work, minimises the necessity for travelling, and minimises the necessity for campus-based learning.
Activity and Return on Investment (ROI) Measurements	When making use of a learning management system (LMS) to provide e-learning, tracing and reporting on student progress is quite easy.
Reduction of Carbon Footprint	E-learning allows virtual testing and quizzing, and promotes paperless assessments.
Flexible	With e-learning, institutions can offer workers and learners the freedom to study at the pace convenient for them – wherever they may be.

Table 3.4: The benefits of e-learning (Ferriman, 2013)

E-learning is discussed in the next section indicating the shift from the theory of education and technology enhanced education, the technological mechanism by which knowledge is disseminated/shared, by which education and learning takes place in the modern age as opposed to the traditional face-to-face.

3.4. E-learning

(eLearningNC, 2014), describes e-learning as a form of learning that makes use of technology to make available an educational curriculum beyond the traditional classroom. In many instances, it denotes a course, programme or degree offered entirely over the internet. A number of terms are being utilised to define learning which is offered online over the internet such as open distance education, online learning, internet learning, computerised electronic learning and more. E-learning is further described as courses offered particularly over the internet, in which the professor may be teaching. It is not offered through a video tape or over a television channel, CD-ROM or DVD. E-learning is interactive in that individuals can also communicate with their lecturers, professors or fellow students. On occasions communications are carried live, where one may "electronically" raise a hand and cooperate in real time and at times the lecture may have been pre-recorded. The lecturer or professor is available to interact, communicate and rate students' participation, assignments and tests online (eLearningNC, 2014; Groff, 2013).

3.4.1. Contextualisation

E-learning has been recognised as a successful mode of training. According to (Mauri, 2013; Docebo, 2014), e-learning has succeeded in five different markets, namely: media and publishing, healthcare, automotive, information security and, lastly, continuing medical education. According to him, success has been reported in countries such as Brazil, Norway, Svalbard and United Kingdom. The internet has not only turned out to be a massive information resource in the globe, but the quickest means of communication. Individuals from various nations have a chance to interact with one another in real time. An electronic mail is faster than normal mail and even airmail, as the e-mail gets over distance in a matter of seconds. As a result, individuals become closer to one another. People have an opportunity to know one another well and to recognise differences and similarities among themselves making it easy to jointly understand one another. E-learning also makes it possible for disabled people and sick persons to learn at schools, colleges and universities by means of online learning (eLearningNC, 2014).

People who study by means of distance learning at schools, colleges, and universities can improve individual knowledge by engaging with educational writings, encyclopaedias, reference books, dictionaries and databases via the internet. E-learning enhances the chances of doing well in group projects in which students can interact with students from other schools, universities and countries, deliberating on various difficulties. Thus, the opportunities which the internet can provide in the domain of education are exceptional. Educators have always carried a responsibility of exploring the didactic opportunities of any discovery, to describe how it can be effectively utilised in the domain of education to outline its didactic tasks (Gul, 2012; Moldova, 2006).

3.4.2. E-learning models

(Theriault, 2015), defines an e-learning model as an imaginary structure that helps experts to design operational learning practices for learners taking part in virtual courses. E-learning models vary from e-learning frameworks in the sense that an e-learning model focuses on the teaching strategies and its impact on the achievement of learning outcomes. The focus is on using technology to obtain enhanced learning outcomes, a more accessible platform, and an affordable mode of taking the learning setting to the students. It is necessary to be clear about the fundamental assumptions while planning for the adoption of e-learning. The e-learning model should reveal the pedagogic principles in which the added value of the ‘e’ operates on. The ‘e’ enables remote students to collaborate with one another and with subject specialists in a way that would be impossible without technology (Mayes & de Freitas, 2004).

A few existing e-learning models are presented below. The terms ‘framework’ and ‘model’ are applied interchangeably in the context of this research. This is because a model is a reflection of a framework but has more technical components and a framework is more abstract or high level.

3.4.2.1. ADDIE Model

The ADDIE model shown in Figure 3.4.2.1 is a method for building e-learning courses and a number of course designers continue to use it.

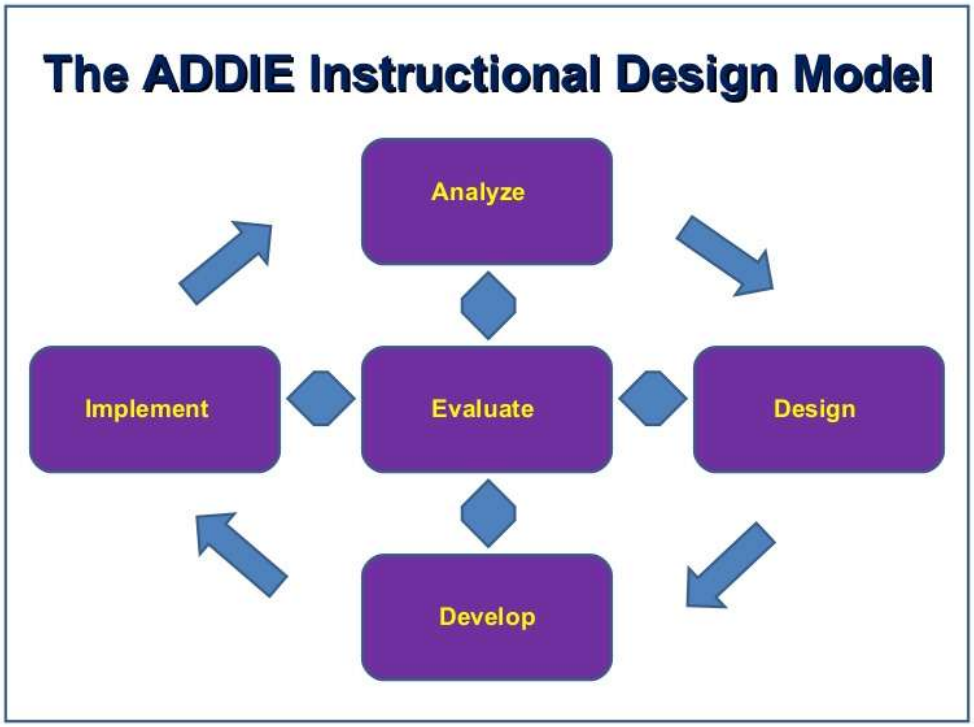

Figure 3.4.2.1: The ADDIE Instructional Design Model (Garret, 2016)

ADDIE is an acronym of its stages which are **A**nalysis, **D**esign, **D**evelop, **I**mplement, and **E**valuate (Garret, 2016). Below is a brief description of each phase of ADDIE:

- **Analysis phase:** This is the first phase of the model in which matters regarding students' skills level and educational difficulties of the course are identified and followed by the establishment of the objectives. This phase offers information such as the types of students together with their profiles; the expected learning outcomes; the current learning difficulties; the available learning platforms or modes; the deliberations with regards to pedagogy; the deliberations with regards to the use of learning theory and development timeline including a due date.

- **Design phase:** Once the analysis phase is complete, the design phase follows. In the design phase, a number of issues are tackled in order to obtain the best course material design and an organised formation of the training package. The deliverable of this phase comprises the learning objectives, course content design, assessment tools, assessments, subject matter,

lesson preparation procedures and learning methods. Every deliverable is developed to satisfy educational needs.

- **Development phase:** In this phase, educational designers and systems developers develop and gather deliverables produced in the design phase. In case of a virtual learning being the learning mode of choice, system designers build a system prototype and systems developers create an e-learning system using the system prototype as a guide. The system undergo testing to ensure that it meets the educational needs as outlined in the design phase.

- **Implementation phase:** In this phase the system is deployed once it has been successfully developed in the development phase. In the implementation phase, programmes to train educators and students are developed. The training of educators covers the course syllabus, learning objectives, methods of learning, and assessment techniques. Training the student entails training them on the use of the new platform, how to access the modules enrolled for, workshop them on the hardware required to access it and demonstrate how to use the features and functionalities of the system to be used by the student. Likewise, the training of the lecturers, administrators, IT experts and managers should also be on how to use aspects of the software pertaining to undertaking online teaching activities. For lecturers, training should include how to interact with the students assigned to them. The administrators need to be trained on how to perform administrative duties such as uploading and downloading of students' assessments and course resources. IT experts need to be trained on how to access and respond to stakeholders' queries while the managers decide what needs to be achieved and must be able to track the overall performance of the system.

- **Evaluation phase:** Once the system is deployed it undergoes continuous evaluation to ensure continuous improvement. This phase is divided into two facets namely seminal and comprehensive evaluation. The seminal evaluation is conducted in every phase while the comprehensive evaluation takes place on the completed product to ensure that the system offers what is expected.

3.4.2.1.1. Advantages

The benefits of the ADDIE model include: offering a step-by-step procedure to help in preparing and generating learning programmes; flexibility, as it provides a number of opportunities to re-examine learning goals and outcomes; its ability to allow for the design and development of learning resources; simplicity, which makes it usable in every type of learning. ADDIE is extremely organised and detailed in including all the elements of other learning design models and offering better results from the student's perspective as each stage is dedicated to assisting students to achieve the desired objective.

3.4.2.1.2. Limitations

The ADDIE model has been utilised in the formation of multimedia content for studying for a number of years, but the model has various serious flaws. It does not cater for backtracking from the current phase to the previous phase. Also, its linearity has a habit of working well with fixed content but is limiting when working with user generated content or learning objectives that do not require a pre-set final state. Another major shortcoming of the model is that it expects that a person should be aware of every requirement prior to developing the content.

The weaknesses of the ADDIE model, according to (AllenInteractions, 2007), are categorised according to phases:

Analysis: processes usually need unrealistically early analysis completion; failure to pay attention to some political realities;

Design: inadequate storyboards tools for generating, collaborating and assessing design alternatives; poor designs are identified when it is already too late;

Development: detailed procedures turn out to be so fixed that creativity gets tough;

Implementation: absence of support and targets shift;

Evaluation: learning programmes are aimed at meeting criteria which are measured but unable to recognise behaviour changes and requires more time.

3.4.2.2. The online learning model

An online learning model (OLM) is an approach for providing a procedure for establishing a technologically enhanced educational system. The model supplements the traditional form of engagement among participating key stakeholders (learners, teachers, content, community and institution). It does so by enabling a fully connected collaborative interaction thereby enhancing students' experience through technology. New suppliers of higher education offer online learning due to the growing number of technological communication devices in use globally. Thus, students learning approach has been transformed. As a reply to these adjustments, institutions around the globe including Charles Sturt University (CSU) from Australia and South African universities have now aspired to become the leaders in online learning. Online learning methods have enabled text-based learning resources to be offered online in the form of the e-books, complemented by forums and chats which is a great improvement on the traditional physical text-based resources with inadequate interactivity and marginal interaction between students and teachers (Moore, 2007).

Figure 3.4.2.2: The Online Learning Model (Moore, 2007)

Figure 3.4.2.2 depicts the overall model in terms of key components. It consists of seven elements designed to increase students' retention, commitment and overall satisfaction. The seven components of OLM are learning communities, interaction

among students, teacher presence, interaction with the professions, flexible and adaptive learning, interactive resources and e-assessment as briefly described below.

- **Learning communities:** The ability to contribute and belong to a learning community depends on a student's inspiration and commitment. Learning in learning groups is a crucial basis for successful collaboration among students and lecturers in support of team learning. Learning communities are places in which individuals from different backgrounds with different levels of knowledge are able to learn from one another while fulfilling learning outcomes. This element ensures the improvement of learner-teacher and learner-learner engagement (Asterhan, Pedersen, & Murphy, 2012; Kim, 2013).

- **Interaction between students:** Online peer learning activities that correspond with the desired learning results and actively driven by an online tutor or lecturer, offer the students' an improved form of learning. The students learn with and from one another which assists in the completion of assessment activities. This element ensures the improvement of learner-learner engagement (Boud, Cohen, & Sampson, 2014; Cho & Kim, 2013).

- **Teacher presence:** The existence of an online lecturer associated with consistent communication enhances students' self-trust which gives them the courage to take part in learning activities. An online lecturer can also help in the formation of learning communities for effective collaboration among students. This element ensures the improvement of learner-teacher, learner-learner and teacher-teacher engagement (Ostashewski, 2015; Sheridan, Kelly, & Bentz, 2013).

- **Interaction with the professionals:** Online tactics to link students with the professionals and websites of expert practice offer a valuable setup for the distribution of the subject content and make clearer the significance of the subject learning goals by linking theory with practice. This engagement aids the formation of professional competencies, orientation into the beliefs and

ethics associated with the profession, and encourages continuous learning and career planning. This element ensures the improvement of learner-community engagement (Dalgarno, Kennedy, & Merritt, 2014).

- **Flexible and adaptive learning:** The variety of modern online learning associates entails learning activities that are intended for high engagement, while at the same time being adjustable and adaptive to the needs of self-directed students. The possibilities of adaptivity in learning design, online teaching and increased student support has become a reality through the utilisation of technologies offering well-timed information on students' knowledge, insights and learning practice. The flexibility with regards to timing and the approach of engagement with lecturers, peers and learning content, together with information-guided responses on learning tactics, can endorse responsive and custom-made learning activities. This element ensures the improvement of learner-learner, learner-content, learner-institutional and learner-teacher engagement (Siemens & Long, 2011; Irwin, Hepplestone, Holden, Parkin, & Thorpe, 2013).

- **Interactive resources:** Rich media learning materials can empower knowledge of theoretical resources by offering visual samples of training and setup a comprehensive learning experience. Collaborative learning assets can offer a space for practical engagement and carrying out of tests using content and collaboration with fellow students and lecturers. Assets can be curated from those offered by businesses in open educational resource libraries and be quality assured by lecturing and learning design workers, students or platform specialists. This element ensures the improvement of learner-content engagement (De Jong, Linn, & Zacharia, 2013; Wills, Leigh, & Ip, 2011).

- **E-assessment:** Technology offers new chances for students to conduct, send in and get feedback from their assessment activities. Reliable assessment activities that call for students to show performances associated with the particular profession can be offered in ways that support them and ensure realisation of specialised and practice-based learning goals. This element ensures the improvement of learner-content and learner-learner

engagement (Dochy, Segers, & Sluijsmans, 2006; Buzetto-More & Alade, 2006; Sheriden, Kotevski, & Dean, 2014; James, 2016).

Student engagement is divided into five categories, namely: learner-learner, learner-content, learner-teacher, learner-institution and learner-community engagement, all of which are associated with three groups of interaction for distance learning. The three categories of interaction are: learner-learner, learner-instructor and learner-content interaction (Moore, 2009; Focus Faculty, 2012). The **learner-content interaction** refers to the procedure of logically cooperating with content that leads to modifications in the learner's understanding, the learner's perception, or the intellectual arrangements of the learner's thoughts. The **learner-instructor interaction** refers to numerous interactions that occur between a learner and a lecturer or lecturer to student(s) such as inspiring student engagement, handing out resources, advising on the use of the resources, assessing learners, making changes to student education along with guiding and motivating learners. The **learner-learner interaction** refers to the interaction which occurs among the students where they interact with one another either in the presence or absence of the lecturer. Every element in this model is intended to enhance one or more kinds of engagements. The elements are supposed to be joined together in different points within the subjects that form a course. Student engagement is described by (Tinto, 2006) as the psychological and physical commitment that the student dedicates to the educational work.

3.4.2.2.1. Advantages

The benefits that are derived from utilisation of OLM include the enhancement of student learning results and accomplishment, reduction of drop-out rate and increase in retention rate.

3.4.2.2.2. Limitations

There are certain limitations, despite the above-mentioned benefits. The main limitation is high attrition which can be overcome through student engagement and retention (Hoskins, 2012; Leach & Zepke, 2011; Tresman, 2002).

3.4.2.3. Massive open online course

The massive open online course (MOOC) refers to website-based learning whose purpose is to offer limitless contributions and contact using the internet (Kaplan & Haenlein, 2016). MOOC supplements traditional learning resources by providing, for instance, recorded learning sessions, readings and case studies. A lot of MOOCs deliver cooperative user forums to allow stakeholders' (learners, lecturers, and tutors) to have communications among themselves. MOOCs are the current and broadly explored enhancement in distance education that arose as a familiar way of learning in 2012 (Pappano, 2014; Lewin, 2013). At first, the MOOCs repeatedly focused on open-access functions like structure, open authorisation of content and learning objectives to support the repeated use and combination of assets. Several MOOCs later chose the utilisation of closed authorisations for course assets while retaining free right of use for learners (Wiley, 2012; Cheverie, 2013; Carr, 2013).

In the past (prior to the advent of computer technology and the internet), distance learning worked as correspondence courses from late nineteen century towards the early twentieth century, followed by radio and television airing of lessons and early forms of e-learning. Usually, the course completion rate was less than five percent. The twenty first century brought about an improvement in e-learning or online and distance education with growing online attendance, open learning opportunities and the enhancement of the MOOCs; particularly in countries such as the United States of America, the United Kingdom, Canada, Mexico, China, France, Spain, India, Germany, Sydney, Malaysia, Australia, Singapore, Ireland, Finland, South Africa, and Brazil, but the focus is on various universities within these countries not TVET colleges (Yuan, 2015; Lewin, 2013; UWC, 2009; Veduca, 2013; Kurti, 2008).

Phases of introduction of a Massive Open Online Course

There are six phases an institution needs to go through in order to assess and conduct an open online course trial, namely, Pre-MOOC Analysis, MOOC trial: Phase 0, Phase I, Phase II, Phase III and Phase IV.

- **Pre-MOOC Analysis:** In an instance where an online course has been identified by an institute of higher learning, the need to check the viability of that particular online course is necessary. In a pre-MOOC analysis phase, the online course would be assessed to check whether it is capable of fulfilling course outcomes and the impact it may have on stakeholder's access and usage. This investigation is necessary in making sure that the course offers positive results. The MOOC trial: Phase 0 only commences when the course offers the best results through the fulfilment of course outcomes. Below are the descriptions, goals and layout of every phase.

- **Phase 0:** In this phase the stakeholders such as students, lecturers and tutors are used to assess a course. Ten to fifteen stakeholders are used. The findings of this phase determine whether to proceed with the following phase or not.

- **Phase I:** In this phase a few stakeholders are used to evaluate the course effect and its capabilities. This first phase usually comprises volunteers, but various instances exist where the actual stakeholders are utilised such as students from disadvantaged background to check if they can cope. Normally, the test duration for this phase is about one to four months.

- **Phase II:** In this phase the course is offered to a bigger set of stakeholders ranging from 20 to 300. The aim is to re-evaluate the success and capabilities of the course. Normally, the phase duration is one to two years.

- **Phase III:** Once the evaluation is complete, confirmation of findings is conducted by offering the course to a much bigger set of stakeholders ranging from 100 to 1000. The success, capabilities and long-term course sustainability are confirmed. Normally, this phase's duration is more than one year.

- **Phase IV:** Upon completion of the third phase, together with approval from the institution's top management, the course is ready to be delivered and may be advertised to prospective students. The course undergoes continuous monitoring and evaluation of shortcomings and impact of the course for a broad variety of stakeholders. A very big set of stakeholders are used in this phase.

3.4.2.3.1. Advantages

Utilisation of MOOCs includes benefits such as offering limitless contributions and contact using the internet; it supplements the traditional learning resources for instance recorded learning sessions, readings and case studies; delivering cooperative user forums to allow stakeholders (learners, lecturers, and tutors) communication among themselves. Basically, MOOCs are an enhancement of distance education that is already a familiar way of learning (Pappano, 2014; Lewin, 2013).

3.4.2.3.2. Limitations

Despite the mentioned benefits, MOOCs have a number of limitations which need to be overcome. The limitations include the lack of earning potential which can make the theory self-supporting; poor course-completion percentage as in many MOOCs less than 10% of enrolled learners finish the course, and poor learner authentication which requires improvement for authorising associations or employing corporations to be sure about a known learner's identity.

3.4.2.4. Bloom's taxonomy

Bloom's taxonomy is a grouping structure of quantifiable verbs to describe and establish various points of intellectual learning (Bloom, 1956). The six dimensions were amended by (Anderson & Krathwohl, 2000) and are now referred to as the "Revised Taxonomy". Figure 3.4.2.4 indicates the original (left) and revised (right) taxonomy. There is a new classification at the top which is "Creating", three

classifications received new names, and the classifications are articulated as verbs instead of nouns.

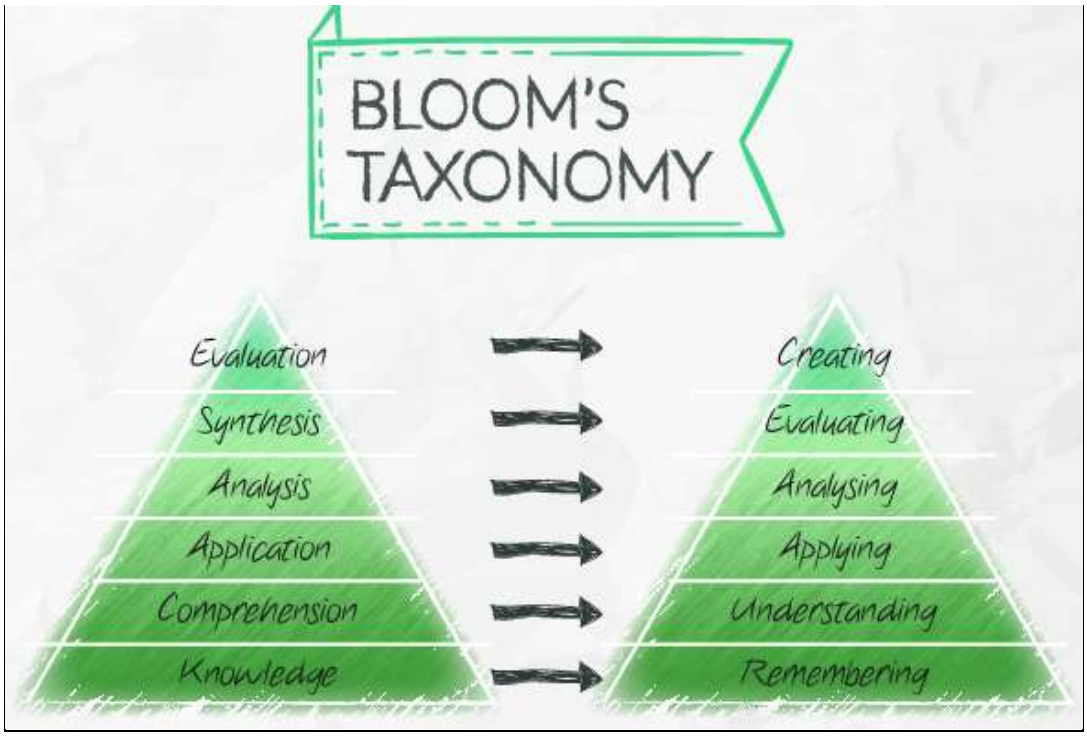

Figure 3.4.2.4: Bloom's taxonomy (Anderson & Krathwohl, 2000)

The taxonomy forces the learners proceeding through the lower stages of learning which are remembering and knowledge and into the sphere of profound application, reflection and understanding of knowledge to cultivate their own problem-solving procedures. This is an ideal technique for setting up learning objectives that provide students with the required content and instil new knowledge and concepts.

3.4.2.5. Bloom's taxonomy as an enabler of an e-learning model

This section is dedicated to demonstrating how Bloom's taxonomy can be viewed as an enabler of an e-learning model. The revised taxonomy is a proper mechanism to design fit for purpose learning material for students, for both face-to-face courses and electronic courses. The taxonomy may help the MOOC model in testing of the quality of e-learning materials to be developed together with the pedagogical aspect of learning. The pedagogy is a fundamental aspect that has been overlooked on the previously described models. These models put more emphasis on technology and less on pedagogy which is the aspect to be emphasised in the proposed framework.

Bloom's taxonomy ensures that online learning is in line with everyday aspects of learning, and that the course delivered supports the achievement of the set learning goals. This can be achieved as indicated below (ISME, 2013):

- Student should *remember* a theory in order to *understand* it
- Once the theory has been *understood* it can be *applied*
- The moment a learner is able to *apply* a theory then it can be *analysed*
- If it can be *analysed*, that means its effect can be *evaluated*
- For it to be *created*, it should have been *remembered*, *understood*, *applied*, *analysed* and *evaluated*.

3.4.3. Barriers to e-learning

It is necessary for TVET colleges to seek an alternative learning platform to substitute or supplement the face-to-face learning. E-learning has a number of advantages as stated in Section 3.4. E-learning can help TVET colleges increase their access as it is expected to enrol more learners than universities (DHET, 2013). E-learning may provide the space for learners to learn in cases where they cannot make it to the college for reasons that may include absenteeism by lecturer(s), learners with a busy schedule and insufficient funds to travel to the college. E-learning today is a crucial learning and teaching environment for students and faculty members. In spite of the efforts and the claims made by many higher education institutions regarding e-learning, there are some barriers hindering numerous faculty members from advancing from the state of understanding and recognising e-learning to the state of truly approving and employing it (Gamdi & Samarji, 2016). The e-learning barriers are sometimes referred to as "Factors affecting the implementation of e-learning". These barriers on the road to a fruitful and efficient acceptance of technology appear to include **internal and external sources barriers** as observed by (Rogers, 2000). Internal sources are associated with the faculty members' outlooks on the direction of technology and their expertise regarding the developing technologies. In contrast, external sources comprise the unreachability and unobtainability of the desired program and equipment, the

inadequate or absence of related procedural and organisational support, and lastly insufficient time and finance (Table 3.4.3).

Barriers classification	Items or barriers included in this category
Internal sources Barriers	Focuses on the value of virtual learning, No appreciation for the utilisation of e-learning, Scared of technology, Inadequate English competence, Lack of mentorship
External sources Barriers	Focuses on students' access, Inadequate training on e-learning, Poor campus network and internet availability, No technical support, E-learning's absence of learning design support, No college plan for e-learning, Inappropriate access to computer equipment and programs, Poor internet security, No funds available for advertising

Table 3.4.3: Groups of perceived barriers to adopting e-learning (Rogers, 2000)

The first order and second order barriers, is an additional outlook in the categorisation of barriers to e-learning as declared by (Sellbom & Butler, 2002) and (Snoeyink & Ertmer, 2002). The extrinsic barriers to technology incorporation refer to first order barriers which comprise the inadequate availability of computer equipment and programs, lack of time, and lack of organisational support. Intrinsic barriers refer to second order barriers which are associated with departmental members' views on learning and teaching, approaches to technology, and their opposition to change. (Ertmer, 1999) pointed out that first order barriers are frequently labelled as asset associated obstacles; as a result, they are simple to quantify and exclude as soon as finance is accessible. In addition, the exclusion of first order barriers enables the second order barriers to show up. They further state that the introduction of technology on a big scale can push departmental members to revert to their primary instruction method. Departmental members should be determined to work on matters such as classroom management, role description, and lesson preparation and designing. (Kerr, 1996), pointed out that as the second order barriers are associated with departmental members' core views on learning and teaching, they are difficult to recognise and expose. Second order barriers are usually more difficult to resolve as compared to first order barriers.

Another grouping of barriers has been presented by (Jones, 2004). These barriers are classified as the educator-level which refers to *personal barriers* versus organisational-level barriers referred to as *college-level barriers*. The personal level

obstructions comprise lack of certainty, lack of time, and opposition to transformation. On the other hand, the organisational level barriers include inadequate preparation and no proper access to computer equipment. A number of investigations have established a link between departmental members' views of technology and their real usage of e-learning equipment. Departmental members with a progressive view of technology are expected to make more use of e-learning equipment in their daily operations than the ones who have a negative view (Shapka & Ferrari, 2003; Teo, 2008; van Braak, 2001) . Some studies have demonstrated that the lack of official support is a key barrier to implementation of e-learning (Al-Senaidi, Lin, & Poirot, 2009; Almuqayteeb, 2009; Alwani & Soomro, 2010; Academia, 2013). A number of recent studies show that a lot of departmental members possess proficiency and confidence in the utilisation of e-learning equipment, yet they continue to make less or no use of the accessible technology as they scarcely have sufficient time (Bingimlas, 2009; Lewis, 2003). Various researchers have recognised the shortage of time and are concerned that the amount of work involved is a barrier to e-learning for higher education institutions (Al-Senaidi, Lin, & Poirot, 2009; Almuqayteeb, 2009; Alwani & Soomro, 2010; Schoepp, 2005; Al-Alwani, 2005; Schieman & Fiordo, 1990).

(Al-Oteawi, 2002), maintains that realising fruitful incorporation of technology into learning needs good specialised improvement courses for workers. Various studies have found that the lack of improvement courses for workers is one of the barriers in the direction of e-learning incorporation in higher education (Schoepp, 2005; Schieman & Fiordo, 1990; Al-Ghonaim, 2006; Mishra & Panda, 2007; Butler & Sellbom, 2002). The incompatibility between workers' workshop and accessible computer programs and equipment is another key barrier to incorporation of e-learning (Al-Mohaissin, 1993; Johnson, 2014). The professional staff members should all do their best to offer departmental members with broad and good specialised improvement courses to allow a fruitful incorporation of new technologies (Keengwe, Onchwari, & Wachira, 2008). The lack of ICT mastery skills from certain departmental workers add to the barriers, together with nonexistence of finance, inadequate organisational support, and scarceness of a formal digital simplicity plan (Johnson, 2014).

The contents of specialised improvement courses should, according to (Keengwe, Onchwari, & Wachira, 2008), be pedagogically linked to learners' learning, include suitable assets, include assessment procedures, be fully funded, have enough time allocated, be supplemented with technical and organisational support, be maintained as a constant procedure, focus on being practical, be tailor-made for all workers together with recently employed individuals, and aim to provide curriculum-driven support to development of specific software. Investigations discovered a series of aspects as barriers to implementing e-learning in higher learning. This study aims to explore how to overcome these barriers in order to allow effective implementation of e-learning in TVET colleges.

3.5. Conclusion

This chapter explored the literature on e-learning and demonstrated that its adoption by TVET in South Africa is crucial for improving the educational system at TVET and for offering quality education to students to enhance the pass rate and throughput rate and harness communities of learning at TVETs.

This chapter explored the theories of education design; technology enhanced education, e-learning models together with their advantages and limitations and barriers to e-learning. The findings of this chapter are that the current e-learning models do not put much emphasis on pedagogy but focus more on technology. Based on findings from this chapter as well as the previous chapter, the next chapter discusses the proposed conceptual e-learning framework for TVET colleges which later undergoes evaluation by TVET stakeholders.

4. A proposed E-learning Framework for TVET colleges

4.1. Introduction

This chapter fulfils sub-objective 3 which is to develop an e-learning framework on which TVETs can rely to effectively and efficiently share knowledge among stakeholders. The proposed framework was developed based on the thorough study done on the existing KS, e-learning frameworks and e-learning models explored in this study.

The fundamental role of this chapter is to explore the literature on topics that helps build a realistic e-learning framework for TVET such that the proposed framework can seamlessly be translated into a technological model ready to be implemented in a real-life context and be adopted by TVET colleges in South Africa.

The topics deliberated on in this chapter include KS principles, e-learning framework dimensions, KS frameworks, e-learning frameworks and the presentation of the proposed framework.

4.2. KS principles

The fact that knowledge exists does not guarantee that it is accessible and available. For knowledge to be accessible, it is important that institutions develop a culture that encourages KS among its stakeholders. For that reason, (Poulfelt & Petersen, 2007) present the six principles of KS which are: knowledge storing, knowledge distribution, knowledge exposure, knowledge transfer, knowledge exchange and knowledge collectivism.

- **Knowledge storing:** This focuses on the availability and accessibility of knowledge. The availability and accessibility of knowledge is tricky as the receiver may not perceive the same meaning as the sender due to noise that can exist at the receiver's side. The sender cannot share all the knowledge as "we know more than we can say". However, this principle urges individuals

within institutions to share their knowledge in support of the institution to ensure that “institutions are not re-inventing the wheel”. This should be done regardless of the culture or race of a person. All individuals should be respected as they all carry essential knowledge and skills that can move the institution forward once kept together.

- **Knowledge distribution:** This focuses on ensuring that knowledge is made available to employees. Making information available to staff means information is given to them – the company does not rely on employee’s ability to look for information. This helps in ensuring that every worker gets suitable information because looking for information requires lot of time. The appropriateness of the information found by employees is not guaranteed as there is a possibility of them finding wrong information. The distribution of information can be achieved by subscribing employees to the appropriate information experts grouped according to their specialisation; to make certain that the right information is distributed to the appropriate personnel.

- **Knowledge exposure:** This focuses on making knowledge visible in a picture format. The passage through which employees pass as they report on and off duty can be used to display knowledge in the form of a poster. In that way every employee can be aware of the knowledge. As a result, every employee can contribute positively to the projects at hand because they are aware. This means that no one interferes with the lessons at hand and everyone know what is expected from them.

- **Knowledge transfer:** This focuses on obtaining new knowledge which is often done by referring workers to workshops conducted by an outside firm. However, this knowledge is difficult to implement once they are back at the company. However, workshops conducted in-house make implementation easy because communication is simple, and any obstacle and boundary encountered can be resolved due to the fact that experts are available on site.

- **Knowledge exchange:** This is concerned with communication that takes place in a specified location and time. Several workers have discovered that a lot of meaningful KS occurs when speaking to a colleague(s) regarding a specific difficulty or task. As a result, it is crucial for workers to be in touch with the knowledgeable workers and be able to collaborate with each other. For large institutions, collaboration can be made possible through online community of practice in which employees can pose questions and get answers from another colleague. Such discussions can then be available for another worker who might face the same challenge in the future which makes the platform goal-driven and resourceful. For this reason, knowledge exchange has become the most essential principle of KS. This principle suggests that the proposed framework should offer a platform in which lecturers and students can collaborate with one another to exchange knowledge.

- **Knowledge collectivism:** This focuses on unity in which knowledge is formed by the community. For the members of the community to feel safe and motivated to share knowledge, it is crucial for members to trust each other. This can be achieved by cultivating a conducive KS culture which can form part of the institution's policy so that whoever disobeys can be disciplined so as to enforce the importance of a good KS culture. A stakeholder such as a student or lecturer who misuses the collaboration platform should be disciplined in order to discourage others from doing the same. As a result, trust grows among stakeholders and encouraged to share.

These principles were accounted for in the proposed framework to make sure that the derived system leverages on the principles of KS to satisfy the stakeholders' needs, especially students.

4.3. E-learning framework dimensions

(Khan, 2005)'s eight-dimensional e-learning framework as shown in Figure 4.3 which is a complete self-assessment mechanism for organisations to establish their own evaluation of technological learning (e-learning) readiness and possible future enhancements. This framework offers an arrangement for methodically reviewing contributions and programs, to make sure that the required learning outcomes are realised. A number of private and public learning establishments, organisations and state agencies have changed their courses and specialised improvement teaching from traditional face-to-face learning to online learning which is e-learning.

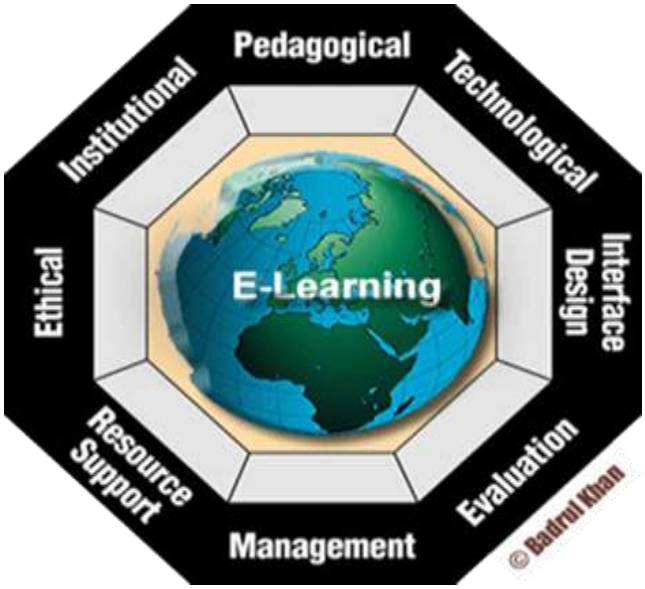

Figure 4.3: (Khan, 2005)**'s eight-dimensional e-learning framework**

Lining up institutional teaching objectives in the direction of a design framework can be of value to the stakeholders (i.e. college principals, subjects' specialists, lecturers, administrators, IT experts and students). It can also enhance the success and effectiveness of the platform. The current learning technology packages are eager to reorganise, revolutionise, or transform the existing practices and systems which can make use of Khan's framework to guarantee success. For that reason, Khan's dimensional e-learning framework consists of fundamental building blocks to ensure that technology enhanced education is sensitive to pedagogical, resource support, interface design, institutional, technological, ethical, management and evaluation issues in order to adequately serve the stakeholders effectively and efficiently.

Khan's framework was crafted in reply to queries from readers calling for samples of effective online learning. The framework excludes a model as it does not suggest an exact procedure for forming educational technology settings. It is concerned with the design, development, delivery, and evaluation of web-based and mixed teaching and also offers direction in preparation and designing of learning technology and mixed-learning resources. It brings together resources for learning technology, virtual universities, both private and public universities and virtual schools. This framework also focuses on the designing of learning management systems (LMS) and a complete authoring system assessing learning technology, mixed-learning programmes, and software packages assessing learning technology building kits/systems i.e. LCMS and LMS (Khan, 2005). The framework is made up of eight dimensions, which are sometimes considered as factors. Every dimension signifies a class of concerns that must be attended to, to enable fruitful experiences. The framework provides a hands-on and comprehensive checklist to function as a self-assessment tool for organisations to assess their learning technology preparedness or future prospects for progress. The full details of these dimensions are described in section 4.7.1.

4.3.1. Advantages

The benefits of Khan's eight dimensional e-learning framework includes provision of a self-assessment tool for colleges to arrange their assessment of e-learning preparedness and prospects for progress; offers an arrangement for methodically revising initiatives and software packages so that the preferred learning results are realised; is able to align institutional objectives and the enhancement of the whole success of the package; considers the design, development, delivery, and assessment of web-based and mixed education and may offer assistance in planning, designing and assessment of e-learning, combined learning materials, resources for e-learning, learning management systems and comprehensive authoring systems.

4.3.2. Limitations

The limitations associated with this framework include absence of a scoring system from the checklist used to assess the college's preparedness and prospects for progression, and the framework does not suggest a specific procedure for developing online learning systems.

4.4. E-learning frameworks

(Riehle, 2000), defines an e-learning framework as a concept from which an electronic learning system is built. It offers a generic way to create and set up an e-learning system. He further states that the execution sequence of the e-learning's declarations, commands or functions is determined by the framework.

4.4.1. E-learning planning framework

The e-learning planning framework (eLPF) is an instrument that assists schools and educators monitor and assess their e-learning competence. The purpose of an eLPF is to enable continuous self-assessment while enhancing e-learning expertise and understanding. It focuses on demonstrating that all objectives set when implementing the e-learning system are met. The objectives include: achieving the learning objectives for each course, reaching the pass rate target, demonstrating that students have mastered their course, that the assessments conducted were up to standard, that the pass rate has improved, that the user experience is enhanced. The eLPF comprises of five stages; every stage should be active for a school to preserve its e-learning's ability to grow over time and improve educators' performance and learners' success rate.

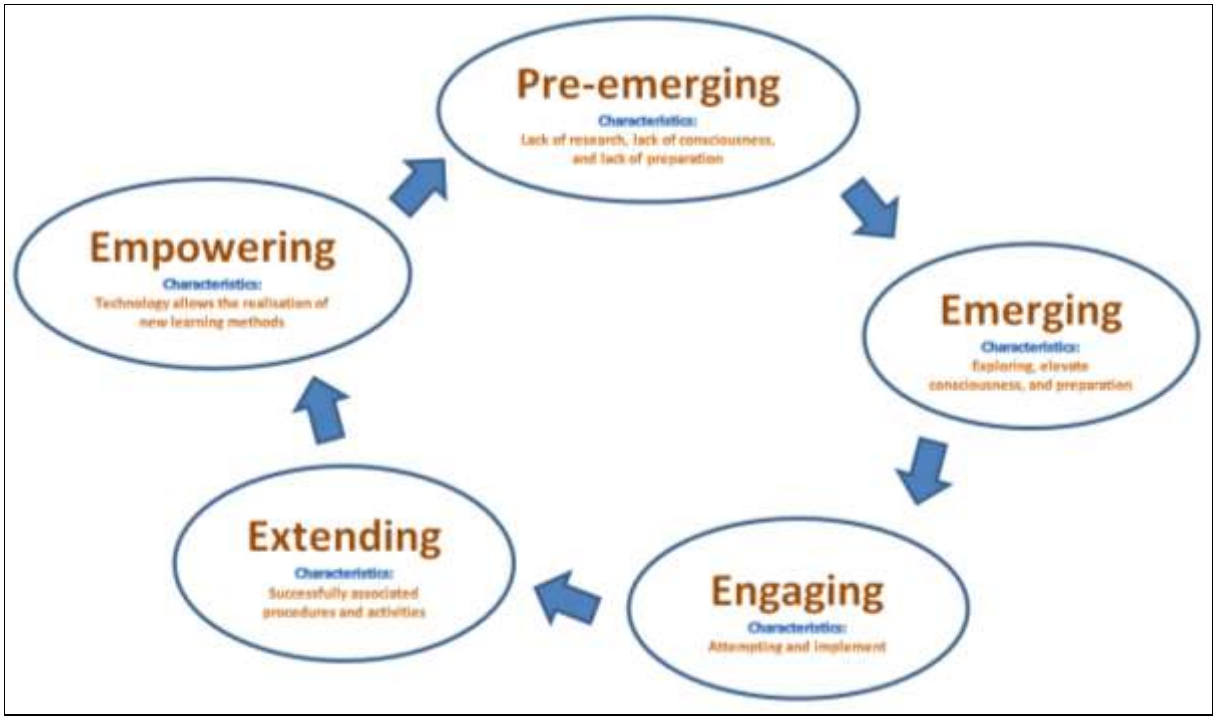

Figure 4.4.1: The e-learning planning framework

The provision of the framework for schools and teachers offers a self-assessment instrument to help schools collect proof on performance; a master strategy for the construction of e-learning competence; a tool to assess the success of e-learning courses and finally the assets together with the services to empower schools while developing competence (Melhuish, 2016; Macdonald & Chiu, 2009).

4.4.1.1. Description of eLPF stages

eLPF is regarded as a capability maturity assessment framework used to determine the appropriate maturity level of e-learning implementation within an institution and relies on the assessment result to make relevant intervention for further improvement. Upon an assessment, the following outcomes can be derived:

- **Pre-emerging:** This is the stage where an institution has no or less awareness of online learning and its role in education. Usually, nothing has been done to intentionally investigate e-learning. The utilisation of technology is not planned, and the school's strategic plan may not include technology. This is presently the case for many TVET colleges in South Africa (see

section 2.8). TVET colleges should, therefore, consider embarking in the journey of doing foundational research for the purpose of developing a knowledge base on technology enhanced education. The characteristics associated with this stage are: lack of research, lack of consciousness, and lack of preparation.

- **Emerging:** In this stage a school starts to explore, elevate consciousness and prepare techniques to be utilised to incorporate technologies in the syllabus and vision of the school. The institution is aware of the technologies which can possibly be added to the classroom as an alternative or supplement to traditional methods. The characteristics are: exploring, elevate consciousness, and preparation.

- **Engaging:** The focus of this stage is to implement the framework identified in the previous stage within a learning institution. It is done by utilising technologies suitable for learners, workers and society's needs. In class, technologies start to play an important role in learning where technologies enhance the learning practice as students interact with lecturers and peers. The characteristics are: attempting and implementing.

- **Extending:** At this stage the school has implemented some aspects of the framework and is considering enhancing those that are required to be expanded or are improving those that have not reached the desired maturity. The characteristics are: successfully associated procedures and activities.

- **Empowering:** An appropriate e-learning system is in place and is effectively in use by all stakeholders. At this stage, the learning institution may consider bringing some more innovation into various aspects to enhance the value of the system and also to enhance user experience. The characteristics are: technology allows the realisation of new learning methods.

4.4.1.2. eLPF dimensions

The eLPF consists of five dimensions which are: beyond the classroom, teaching and learning, professional learning, leadership and strategic direction, and technologies and infrastructure.

- **Beyond the classroom:** In this dimension the institution assesses ways to interact with the society away from the classroom by means of technologies which may include paperless newssheets and e-portfolios.

- **Learning and teaching:** In this dimension an assessment of how the TVET syllabus may be empowered using technology in ways that show cultural diversity is carried. It comprises online learning for the syllabus of the entire college, technology literate, knowledge areas, pedagogy and assessment.

- **Professional learning:** This dimension focuses on how lecturers develop their e-learning competence within the college and its networks. It covers how the college plans to preserve a professional e-learning society and enable the professional analysis of e-learning which involves coaching and mentoring.

- **Leadership and strategic direction:** This dimension assesses how to incorporate e-learning into the vision, leadership, strategic direction and policy (ies) of the college.

- **Technologies and infrastructure:** This is the dimension where the supervision and acquisition of digital technologies and technical support are assessed.

4.4.1.3. Advantages

The benefits of an eLPF include the ability to offer TVET colleges and lecturers with: a self-review instrument for colleges to gather evidence on technology usage; a guideline for the formation of e-learning competencies; an instrument to value the

success of e-learning platforms and finally the assets together with the services to empower colleges while developing a competence.

4.4.1.4. Limitations

The limitations of the eLPF include lack of accountability meaning that one cannot use it to hold stakeholders accountable and it may not be used as a standalone system.

4.5. Knowledge sharing frameworks

4.5.1. Merrill's principles of instruction (MPI)

The model strongly focuses on instilling as much knowledge as possible from every single course; MPI is recalled as the first principles of instruction. According to the proposal by (Merrill, 2002), this model completely incorporates the five principles of learning as shown in Figure 4.5.1.

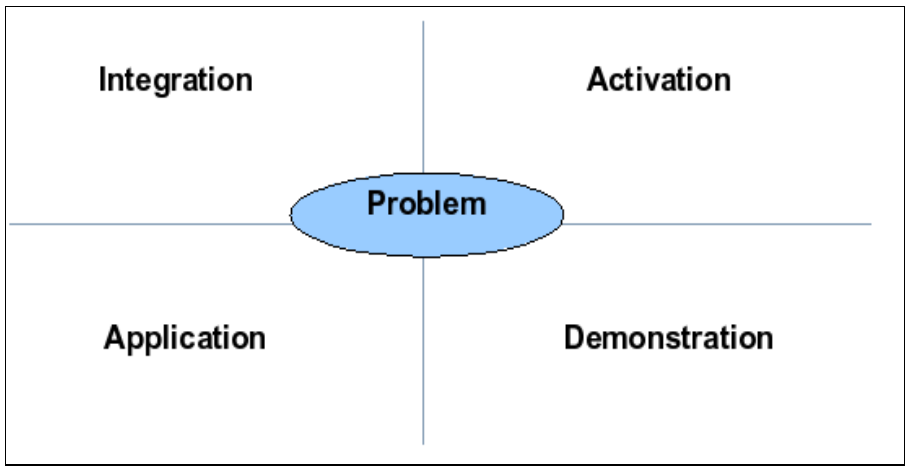

Figure 4.5.1: Merrill's principles of instruction (MPI)

4.5.1.1. Advantages

The main advantage of the MPI model is that it is student-centred as Merrill's principles focuses on students' achievements. The four phases inspire the lecturer to arrange lessons in a manner that best involves and inspires the learners. These

principles provide the student with the chance to run through the session and execute knowledge, skills and values according to the learning outcomes.

4.5.1.2. Limitations

Limitations in the theory possibly depend on its failure to be accessible in every teaching space. The execution of this concept relies on the training styles and atmosphere within the institution. Learning guidelines that demand the lesson and assessment format with little time allocated can undermine the successful execution of this concept.

4.5.2. Gagne's nine events of instruction

(Gagne, Wager, Golas, & Keller, 2005; Stollings, 2015), recommended a model which entails a set of events grounded on the behaviourist approach to learning. The events follow an organised instructional design procedure, building a flexible model in which events can be adjusted to accommodate various learning situations.

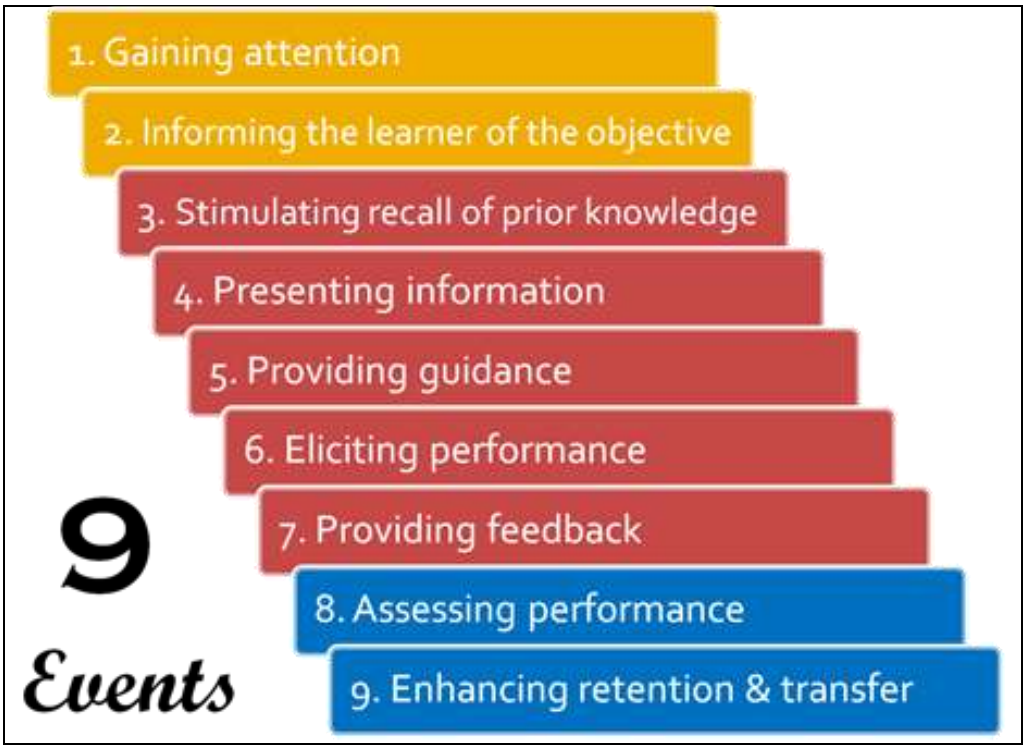

Figure 4.5.2: Gagne's Nine Events of Instruction (Gagne, Wager, Golas, & Keller, 2005)

4.5.2.1. Advantages

The benefits of Gagne's nine events of instruction include offering trainers and educators with a checklist to apply prior to engaging in training or teaching events: every period highlights a type of interaction which supports the learning procedure; as soon as every stride is accomplished in turn, students are expected to participate and to keep the skills and information being imparted; Gagne's model can be modified to suit the necessities of various students; allows the use of appropriate methods to help achieve learning objectives when conducting a lesson; with this model a lecturer can remember how to structure a session to ensure students receive the best possible learning experience (MindTools, 2012).

4.5.2.2. Limitations

The challenges facing Gagne's model include: more support required when offering a new skill; learning/teaching steps can be confusing in a case where the result may possibly take multi-directions; lack of independent research; it could produce students who constantly need support whenever the solution is needed; certain course inventors find this method to be dull and very easy way for teaching design (ActiveLearningTheories, 2012).

4.5.3. Advantages of the existing e-learning frameworks

Education and training signify a crucial step towards financial success; and based on a manner in which such skills are imparted, virtual learning may change one's life opportunities. Industry market indicators point out that labour growth is significant because of ICT-associated proficiency (DEWR, 2005). The adaptable supply of vocational training is considered to be making a substantial contribution to Australia's switch to the information economy (Kilpatrick & Bound, 2003; EducationNetworkAustraliaVETAdvisoryGroup, 2000). In practice, the significance of continuous learning for everyone has been perceived to be progressively essential in allowing the switch to occur successfully (Kearns, 2004).

Obtainable studies identified a small number of clear instances of ICT adding to enhanced learner results, with the number of substantial outcomes showing that results were similar to the ones obtained in old-fashioned environments (Brennan, McFadden, & Law, 2001). On the other hand, numerous written samples of excellent learning effects and gains have been presented that have arisen from the use of ICT which demonstrate the possibilities of virtual learning. The benefits mentioned include its adaptability in time and place, offering self-driven learning, saves time and is cheaper as there is no travelling and costs of child care for studying mothers. The use of ICT platforms nurtures expertise in computer and related equipment providing prospects for literacy which go further than course content (Gatta, 2003).

Additional gains recognised by researchers include the improved standard of learning; better learning throughput; expanded access to learning; better student outlook towards learning; opportunities to network worldwide and obtain universal understanding of difficult matters; improved communication between part-time students and their lecturers by means of computer-aided conferencing and email; motivate students to control their own learning; take learning opportunities that do not need travelling from home which are expensive; improvement of computer literacy skills as students use computer-aided offerings; additional improvement of skills in resolving problems and self-confidence for learners reacting positively towards online learning; energetic engagement of students in educational practice because of collaboration; scholars have a chance to connect with their peers for learning; usage of databases and web pages and additional assets not simple to access in the absence of web-powered tools (Brennan, McFadden, & Law, 2001; Kilpatrick & Bound, 2003; Choy, McNickle, & Clayton, 2002).

Individuals questioned backed the research writings regarding the discovered gains in connection with e-learning. These benefits have been classified into two groups which are individual and organisational benefits. Organisations stand to benefit the most for being able to modernise learning quickly, to be on track with transformation, and to increase productivity in the utilisation of workers time and assets. Benefits for individuals include: influencing more students in the learning process; students can study anytime and anywhere; offers the chance to distribute knowledge among

students; improvement of IT-associated expertise; promote independent learning expertise; improved availability of learning prospects by conquering challenges of part time learning; greater ability to balance studying and work responsibilities. According to most participants interviewed, e-learning promotes a favourable learning environment where applicable content, pedagogy and new ways of learning are communicated.

4.5.4. Limitations (barriers) of existing e-learning frameworks

E-learning today is a crucial learning and teaching environment for students and departmental members. In spite of the efforts and the claims made by many higher education institutions regarding e-learning, there are few obstacles hindering departmental members from advancing from the point of understanding and recognition of e-learning to the point of truly approving and employing it (Gamdi & Samarji, 2016).

E-learning barriers are sometimes referred to as “Factors affecting the implementation of e-learning”. These barriers on the road to a fruitful and efficient acceptance of technology seem to include **internal and external source barriers** as observed by (Rogers, 2000). Internal sources are associated with the departmental members’ outlooks in the direction of technology and their definite proficiency level on the developing technologies. In contrast, external sources comprise the unreachability and unobtainability of the desired computer programs and equipment, the inadequate or absence of related technical and organisational aid, and lastly the insufficient time and finance around internal and external sources. (Kilpatrick & Bound, 2003), classified e-learning barriers into three categories, namely, connectivity related, capability related, and content related. They are further detailed as follows:

Connectivity related barriers include high hardware and software prices, and absence of suitable infrastructure (mostly in rural centre) which deter access, while layout of web platforms and design are of poor quality. **Capability related barriers** consist of poor induction for students and lecturers; absence of suitable

infrastructure (mainly in rural centre); inadequate support for students; layout of web platforms and design are of poor quality; poor collaboration among students, or among lecturers and students; insufficient support and specialised improvement for lecturers and an organisational learning culture. **Content related barrier:** Learning processes constrained by subject content which is not simple to translate online.

4.6. The Value of e-learning in TVET colleges

Learning was quite straightforward until early in the twenty first century when internet was incorporated to education. Prior to that education took place in a traditional classroom of students with a lecturer leading the course. Physical attendance was the only means of learning otherwise learning would not occur. The internet materialised and gave birth to e-learning. E-learning is on the rise, having started way back in the 1980s in the form of distance learning and televised courses (TalentLMS, 2010).

4.6.1. E-learning supports the organisational goals

Reduced expenses. Generating learning content takes lot of time either online or not. E-learning saves cost through minimised travel, material and general maintenance such as cleaning of the learning venue.

More convenient. E-learning is not dependent on a geographical location or time. Students and lecturers can interact with one another from the comfort of their home.

Standardisation. One may be a good facilitator; however, it does not offer the assurance that the modules are taught in a similar manner across sessions. E-learning easily lets one create standardisation and uniformity in the offering of content.

4.6.2. E-learning supports the learner's development

Real-time access. In a traditional face-to-face learning, tasks call for those who learn to align their schedules to the learning timetable. With e-learning this is not the case because modules can be retrieved anywhere, anytime.

Improved retention. The mixture of interactive programs and educational design offer a fruitful learning practice which can be repeated. It may include excellent practical assignments in which feedback is given to students. Such learning platforms help students retain the course content and keep students happy and as a result, students continue doing the course and improve student retention rate. (Articulate.com, 2010)

4.7. The proposed e-learning framework

The foregoing investigation provided a comprehensive set of instruments that needs to be accounted for when developing an e-learning framework. As per discussion in previous chapters, the terms framework and model are used interchangeably in this dissertation. A framework is the basis for seamlessly deriving an architectural model that forms the basis for the improvement and implementation of an e-learning system. Material covered previously in this chapter helped us identify basic elements or components that should be part of an e-learning framework in such a way that they can be translated seamlessly into an architectural model ready for development and implementation. This section relies on the explored literature on KS principles, e-learning dimensions and eLPF to propose an e-learning framework that can be adopted by TVET colleges. The proposed framework can form the basis for further investigations in terms of its suitability in a TVET context and its implementability. Figure 4.7 depicts the proposed framework followed by a comprehensive description of its components as well as an explanation on how it can be seamlessly translated into an architectural model for implementation in a real-world context.

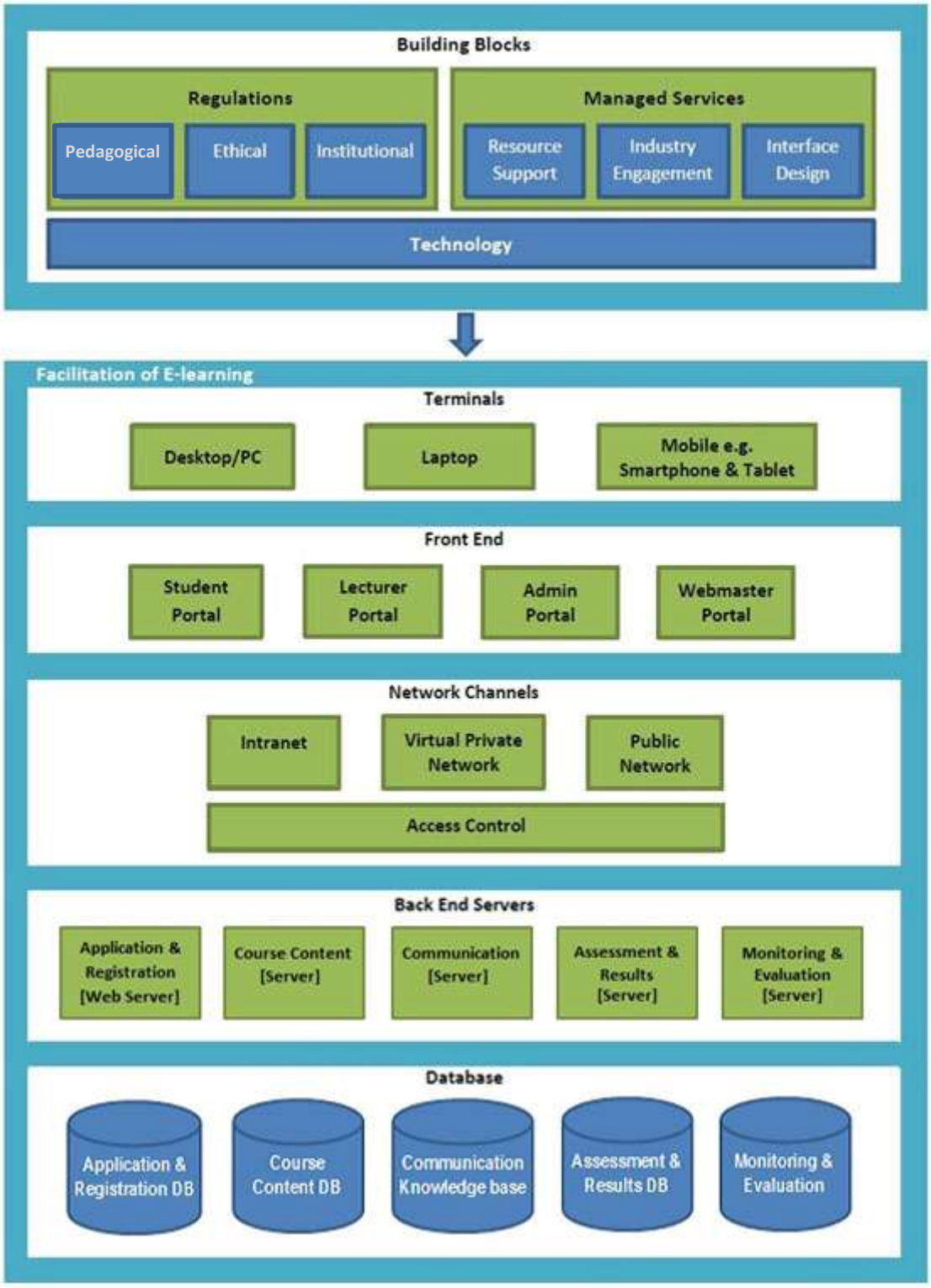

Figure 4.7: The proposed e-learning framework

The proposed framework as depicted in Figure 4.7 comprises three fundamental layers, namely: building blocks, facilitation, and monitoring and evaluation described in the following sub-sections.

4.7.1. E-learning building blocks

E-learning building blocks are made up of (Khan, 2005)'s eight-dimensional e-learning framework as shown in Figure 4.7, which is a comprehensive set of elements that ought to be considered when implementing an e-learning solution. To ensure that the complete body of knowledge required for a well-functioning learning institution forms is incorporated into the e-learning solution. Each element of Khan's framework needs to be included when implementing e-learning. However, having knowledge of Khan's framework does not necessarily mean that one would immediately and seamlessly implement e-learning. The framework needs to be further unpacked to provide a well formulated framework. The framework should be readily translated into architecture and a prototype after being evaluated by TVET stakeholders using a survey, which is a key contribution of this paper.

At the core of any e-learning solution, there ought to be some foundational constructs that drive the delivery of appropriate artefacts in order to make any learning or educational endeavour a success (Millichap & Vogt, 2012). Those core artefacts sit at the heart of the education system itself. A sound education system is grounded by its values and deliverables that enable all stakeholders to achieve their target mission in the whole education value chain. As such, all participating stakeholders must be able to ascertain that their intended objectives have been researched throughout the learning process. As advocated by Khan in (Khan, 2005), it is of utmost importance to accommodate in the framework a range of fundamental building blocks regarding process, governance and practice for the technology to be effective. In fact, technology is only considered as an enabler in the sense that if fundamental building blocks are not well-defined the inherent technological deliverables fail to meet stakeholders' expectations. The various components that make up the foundational building blocks of the proposed framework are the following:

- **Pedagogical:** This dimension refers to matters such as content examination, audience assessment, design, objective assessment, and tactics and methods that evaluate the philosophies and modes of teaching (i.e. learning

and teaching). It relates to the design of the course content; determines students' necessities; and determines how the learning goals can be realised. It also comments on the delivery mode for the programme events and the suitability of the online setting for realising the learning objectives of its envisioned participants. In cases where online or traditional approaches are not viable, this building block allows interested parties to advocate other choices, comprising a blended learning approach which associates features of online and classroom learning.

- **Technological:** Technological aspects relate to the computer equipment, programs, and asset preparation. This dimension also includes as well as the choice of the most appropriate LMS and interaction instruments such as platforms for video conferencing and audio to attain the organisation's learning aims and goals. It also focuses on technical requirements which include the server capabilities, security, backups, bandwidth, and other infrastructure issues.

- **Interface:** The interface design dimension focuses on the five sub-aspects that are concerned with the complete appearance and sensation of a learning technology programme. The five sub-dimensions are website design, navigation, accessibility, content design, and usability testing. With virtual students, an operator's interface is the first item they see as they sign-in to a programme. The initial impression learners get from a programme is frequently centred on the website's operator interface look and usability.

- **Evaluation:** This dimension focuses on the appraisal of students and assessment of the accomplishment of learning outcomes. Evaluation serves as an improvement mechanism. This also involves an audit of the instructional outline methodology (i.e. arranging, planning, advancement and assessment); and assessment of e-learning at the programme and organisational levels.

- **Management:** This focuses on the persistence, improvement, and preservation of the learning atmosphere. Persistence can be used to find out

if the educational technology environment is doing well, and check if the instruction is achieving its purpose. It is also concerned with quality control, costing, employment of staff, safety, and scheduling.

- **Resource support:** Takes care of all the technical and personnel assets needed to empower significant and fruitful creation of virtual learning settings. The support facilities consist of web-based and phone technical-aid, online tutorials, electronic archives, circulars, podcasts, journals, indexes, FAQs, and occupation advisory facilities.

- **Ethical:** This relates to societal and politically-aware guidance, bias, diversity, legal matters, the digital divide, good manners, and information availability. Legal matters relate to plagiarism, secrecy and copyright concerns.

- **Institutional:** This focuses on three aspects which are: matters of organisational affairs, student facilities associated with learning technology, and academic affairs. Organisational affairs matters refer to entries, information technology services, financial-aid, enrolment and payment, graduation, and ratings. Academic affairs are associated with authorisation, rule, course value, department and support personnel, and number of students per class. Student services cover all areas from advising and library assistance to book-shop, work placements, and graduate matters. Each of the declared matters needs to be considered for a smooth implementation, before introducing a completely online program. Online students are not required to set foot on campus in order to make use of or benefit from student services (Khan, 2007).

4.7.2. Facilitation of e-learning

According to (Xiaofei, Abdulmotaleb, & Georganas, 2003), facilitation of e-learning consists of five layers, namely, terminals, front-end, network channels, back-end servers and database to be monitored and evaluated.

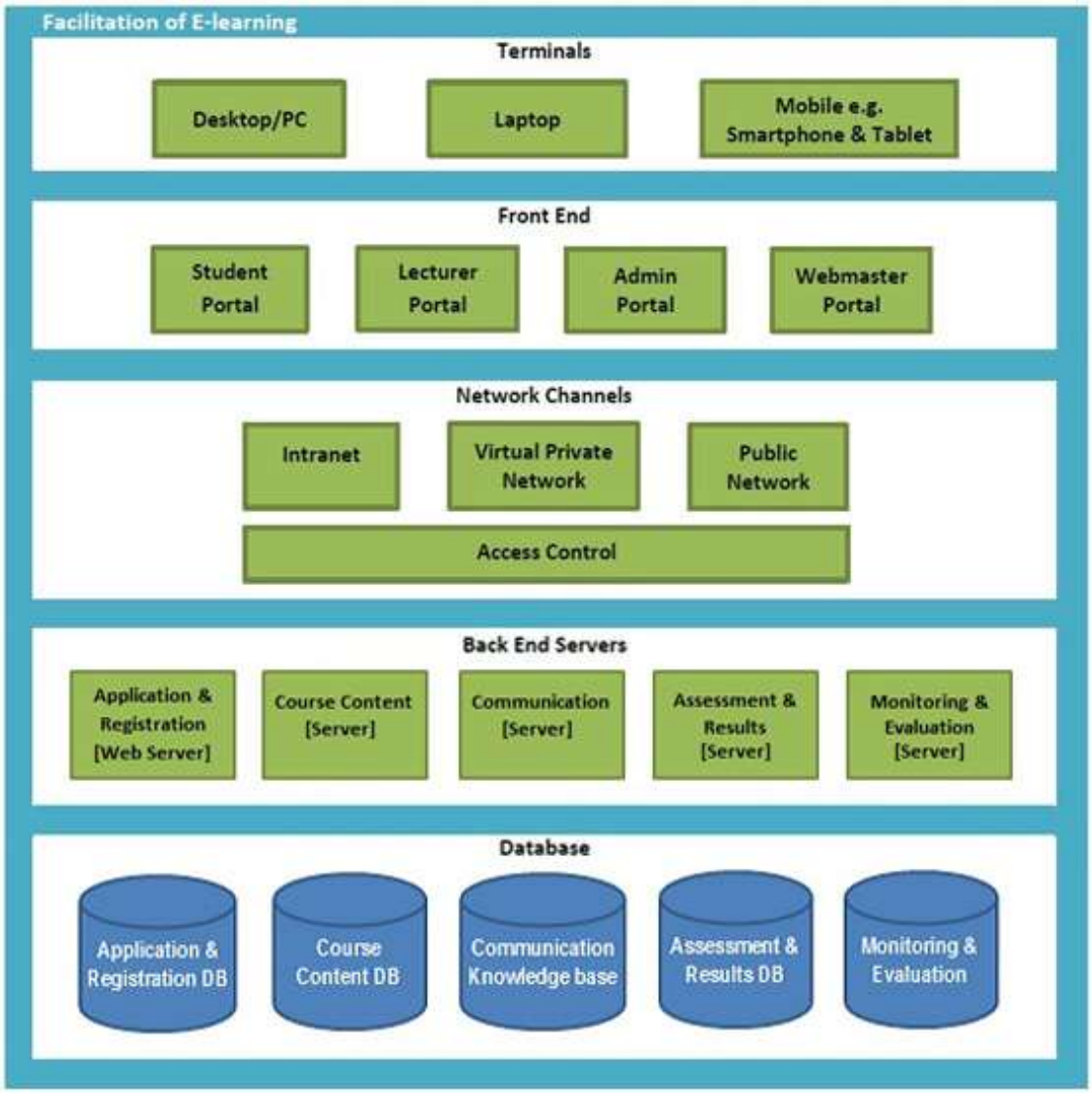

Figure 4.7.2: Facilitation of e-learning

4.7.2.1. Terminals

(BusinessDictionary.com, 2011), describes a terminal as data input-output equipment normally consisting of a screen (display), mouse (pointing), keyboard (typing), or touch screen. This is the device that allows an operator to interact with the system via the network. It is through a terminal that the user can be able to access and utilise the services offered by the system. Research by (TopUniversities, 2013), on the most popular internet devices for students reports that many respondents indicated that smartphones were the most frequently used internet devices, especially for those younger than 21 years. Tablet usage was reported to be less for all age groups. On the other hand, laptops remain the most frequently

used internet device for all age groups. Desktops were commonly used by the oldest age group. As a result, it is good for an e-learning system to be compatible with terminals such as desktops/PCs, laptops and mobile devices (i.e. tablets and smartphones) to accommodate everyone (Gopalan, 2011; Taliesin, 2010).

4.7.2.2. Front-end

This is an element of the information system which can be regarded as the face through which the operator can obtain and use back-end services of the system. It allows operators to gain entry and utilise the services and features of a particular information system. The front-end structure can be a software program or a mixture or computer equipment, programs and network assets (Techopedia.com, 2003). From an institutional point of view, this involves three aspects which are *administrative affairs*, *student services* related to educational technology and *academic affairs* (Khan, 2007).

Ideally, an e-learning system should support academic affairs, student services and administrative affairs. The front-end therefore consists of a student portal, lecturer portal, and an administrator portal to grant students, lecturers and administration personnel specialised access to the e-learning system. Additionally, the webmaster portal must be added in order to allow IT experts to offer technical support to students, lecturers and administration personnel. However, it is necessary for students, lecturers and administration personnel to be equipped with the necessary methodological skills to solve some of the technical problems that they might encounter (elearning.tki.org.nz, 2013).

4.7.2.3. Network Channels

To ensure that only authorised personnel gain access to an e-learning system; it is essential to have access control mechanisms. Access control deals with access approval, in which the system makes a judgement to award or refuse a right to use from existing valid operators, depending on what the operator is certified to use and view. Verification and admission control are frequently joined into one action, for

access to be approved depending on an acceptable confirmation, or depending on the unspecified access token. Confirmation techniques and tokens consist of biometric scans, patterns, passwords, electronic keys, physical keys and devices, out of sight pathways and checking by persons and computerised mechanisms (Jain, 2013).

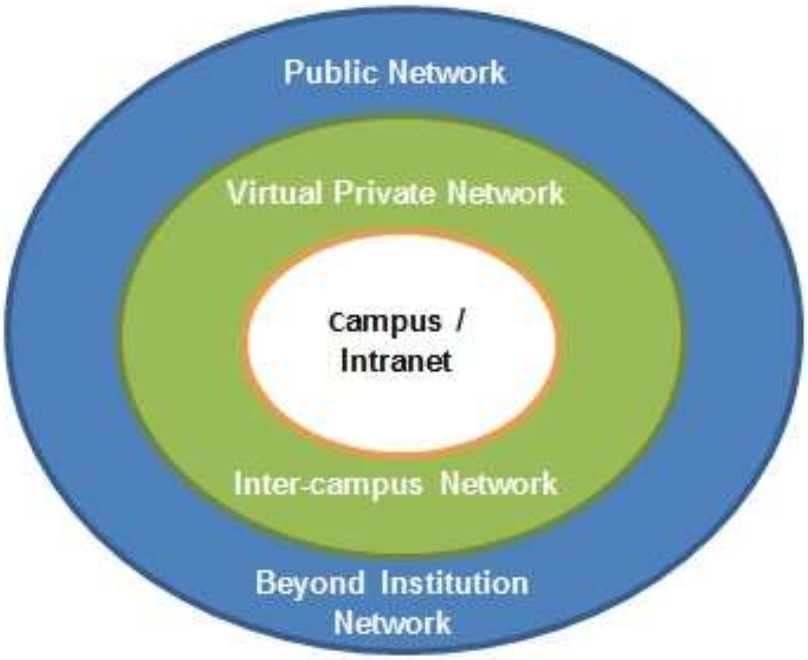

Figure 4.7.2.3: Network for secure communications (IBM.com, 2014)

The intranet is a campus network which is one of the networks that ensures that access is granted to online learning within the campus of an institution. The virtual private network is an inter-campus network which is expected to be one of the networks to ensure access is granted to online learning across campuses of an institution. The public network is one of the networks that ensures access to online learning away from the institution for TVET stakeholders and the public (IBM.com, 2014). See Figure 4.7.2.3 above.

4.7.2.4. Back end servers together with the corresponding database

A back end system is any system that helps back-office practices. Behind-the-scene systems are utilised for commercial management and operate by getting operator input and collecting contributions from other systems to offer flexible results

(Techopedia.com, 2003). The features and functionalities that should be made available to e-learning operators are:

- **Online application and registration** (including uploading documents, updating applications and registrations);
- **Access to course content** (limited to modules enrolled for);
- **Communication** (among students, lecturers, administration personnel and webmaster using e-mail, discussions and chats);
- **Assessment and results** (to do assessments and receive results); and
- **End-user rating** (system users to rate system usage in terms of the current features and functionalities to ensure continuous improvement) (CommLabIndia.com, 2014).

The proposed framework was evaluated by experts from TVET colleges across the country for inputs.

4.7.2.5. Monitoring and evaluation

The monitoring and evaluation portion of the framework does similar work to what eLPF does. It enables one to gauge the maturity of the framework at component level in order to establish whether there should be improvement or not. The monitoring and evaluation component of the framework can be considered as a component that constantly tests the maturity of each component in the framework against best practice to determine its present point of maturity and propose a set of interventions that can be undertaken in order to improve the maturity of that given component. For example, the monitoring and evaluation component may realise that the maturity of “pedagogy” is low because the systems, from a pedagogy perspective, have not followed the prescribed best practice for the design of pedagogically sound course material and learning approach. As such, the desired maturity objective for such an outcome can be to enhance the pedagogical approach of course material and KS principles in order to increase the score of the maturity of the pedagogy component in the system and therefore deliver a good maturity level from a monitoring and evaluation perspective.

4.8. The derived architecture of an e-learning system

All the components of the framework have been discussed in the previous section. Section 7.4 briefly demonstrates how the e-learning framework can be translated into an architectural system for seamless implementation in a real-life scenario. In order to achieve this, a range of components are identified that can be represented in electronic form such that the combination forms the outcome of the main objective set out for e-learning in TVET colleges, which is the delivery of good quality content to students and enabling them to participate in the learning process anywhere at any time. The components are described from the lowest layer to the highest layer that is from the database to the front-end.

- **Knowledge base:** This is where the knowledge/database of each core activity of e-learning takes place. Each of these knowledge bases are built based on the fundamental building blocks mentioned in the framework. They each have rules governing each building block. For example, the course content knowledge base relies on the fundamental pedagogical, ethical, and cultural principles. It ensures that course content does not discriminate based on culture, race and background but rather focuses on the achievement of the learning objectives.

- **Back end engine:** These are specialised servers for each e-learning module that is accommodated in the system, such as registration server, chat server, course servers, assessment servers, and monitoring and evaluation servers. Each of these servers interacts with the knowledge base to extract relevant information for presentation to the end-user be this a student, lecturer, administrator or an IT expert depending on their role in the platform/system.

- **Communication channels:** The medium chosen by the source to convey the information is referred to as a communication channel. This is where information is transferred from the end user to the back end and vice versa via the front end. It connects stakeholders with the services offered by the system in such a way that when the communication channel is unavailable

there can be no interaction with the system meaning that services offered by the system can be unavailable. For instance, a student who is at the campus can connect via intranet which is the campus network (Patel & Sonber, 2009).

- **Front end:** This is the access medium used by stakeholders to access the e-learning system. It can be presented as a portal in any form of device (mobile, laptop or desktop) which ought to be designed according to the devices' characteristics to provide a good user experience. The e-learning system should be responsive so that it can accommodate various device types such as mobile, laptop or desktop. Responsive design refers to system design that permits the use of diverse Cascading Style Sheet, styles founded on user's browser width. As a result, the system becomes mobile friendly as it consists of small size pages and loads faster in portable devices and is able to serve many users with different devices which guarantees usability and satisfaction (Tafreshi, Marbach, & Norrie, 2017; Marcotte, 2010).

- **Monitoring and evaluation engine:** Monitoring and evaluation can be achieved through continuous end-user rating of the system's features and functionalities to ensure that quality courses are presented in a proper manner. The end-user rating allows continuous improvement of the system.

4.9. Conclusion

This chapter presented the proposed e-learning conceptual framework. The proposed framework has been presented and the layers together with its components have been described. The proposed framework has been derived from existing literature and underwent evaluation by TVET stakeholders using a survey. The chapter also explored KS principles, e-learning framework dimensions, e-learning frameworks, KS frameworks and the value of e-learning in TVET colleges which have been incorporated into the proposed framework.

The next chapter provides the details on how data was collected when evaluating the proposed framework.

5. Data Collection

5.1. Introduction

This chapter fulfils sub-objective 4 which is to evaluate and validate the framework in a real-life environment of identified TVET colleges. Sub-objective 4 was fulfilled by responding to research question 4 which is "Which techniques can be used to evaluate and validate the framework in a real-life environment of identified TVET colleges?"

The evaluation and validation of the proposed framework by TVET colleges assist in building a convincing e-learning framework for these colleges. As a result, the improved framework can effortlessly be transformed into an e-learning prototype prepared to be employed in a real-life setting and embraced by TVET colleges in South Africa.

This chapter describes how the proposed framework was evaluated. The scope of the chapter covers how data was collected, the research setting, research approach and design, data collection, the study population and sample, reliability and validity, pre-testing the survey and the ethical considerations.

5.2. Research approach and design

In this study both qualitative and quantitative research methods were utilised. Qualitative research describes and measures descriptive data which may include existing literature or research. In addition, questions that require more than one-word explanations as an answer are frequently used. Open-ended questions are used such as "Why do we need an e-learning system?" and "If so, substantiate your answer". Quantitative research techniques describe and measure the occurrences of incidents through numbers. Additionally, questions such as "how frequently?", "indicate your gender" and "how many?" are frequently asked in quantitative researches. (Burns & Grove, 2005), define quantitative research as an objective, organised, formal procedure that makes use of numerical data to gain information

about the world. The approach is utilised to describe factors, scrutinise connections among factors and determine cause-and-effect interactions among factors. Closed-ended questions are frequently used when conducting quantitative research.

The existing literature or research explored from Chapter 1 to Chapter 4 form part of the qualitative research in this study. A survey formed a quantitative component of the study, made up of closed-ended questions. A survey is a data collecting technique utilised to collect, analyse and interpret the thoughts of a collection of individuals from a target population. Surveys have been utilised in several areas of research such as marketing research, sociology, science, technology, psychology and politics (Sincero, 2012; Weimer, 1995). A survey was used as an instrument to evaluate the proposed framework by TVET stakeholders. In this research the information was gathered using self-administered questionnaires disseminated personally and over the internet to participants by the researcher. A survey was chosen as a tool because it allows correct representation or account of the characteristics, such as beliefs, ideas, capabilities, behaviour and knowledge of a specific item, person or circumstances. A survey was used to help realise the research's intention which was to allow principals, campus managers, subject specialists, lecturers, administrators, IT experts and students from TVET colleges to evaluate the proposed e-learning framework presented in Chapter 4.

5.3. Research setting

The survey targeted nine public TVET colleges across South Africa from which two campuses from each college were considered. Of the two campuses of interest, one campus was from an urban area and the other from a township.

5.4. The study population and sample

A population is defined as a research entity and is comprised of persons, collectives, organisations, events or the circumstances to which they are exposed (Welman, Kruger, & Mitchell, 2005). The population of this study comprised adult individuals occupying positions such as college principals, campus managers, education

specialists, IT experts, administrators, lecturers and students. The students in public TVET colleges are more than 700 000 in 50 colleges with 232 campuses across the country (TVETColleges, 2017).

It is difficult and very expensive to include every member of the population in an investigation project; in most cases the populations that concern human behaviour researchers are quite big and from a practical perspective it is very difficult to let them all contribute to a study. The census conducted in 2001 cost ±R632 million, with a population size of 44.8 million people (Statistics, 2001). Thus, it is necessary to use a sample population. (Minitab, 2017), defines sample population as a sub-set of a population chosen to contribute in the research; it is a portion of the whole, chosen to take part in the research project. In this research, the sample consisted of 432 participants chosen from nine public TVET colleges.

5.4.1. The sampling criteria

Choosing a sample is an essential phase as it determines the group of prospective participants from whom the results of a study are generalised. The aspect of generalisability is exceptionally important because outcomes can be generalised from a sample to a population that the conclusions of the study have significance further than only the environment where they were originally obtained. For the outcomes to be generalisable, the sample has to be representative (Welman, Kruger, & Mitchell, 2005). The sample population which participated in this study represents the actual population that exists in public TVET colleges of South Africa. The criteria for selecting research participants were as follows:

- Be an adult of 18 years or older
- Any gender or race
- Be willing to participate
- Be mentally sound in order to consent to participation
- Working or studying in a public TVET college of South Africa
- Occupy one of the positions that is college principal, education specialist, it expert, administrator, lecturers and students in order to make relevant contribution

- Represent all nine provinces
- Represent both business and engineering studies
- Represent urban, rural and township areas

Participant's Occupation	Number of Participants per college	Total (for all nine colleges)
Lecturers and Subject Experts	15	135
Students	20	180
Administrators	5	45
IT Experts	5	45
Principalship *(Principals or Deputy Principals: Academic)*	1	9
Campus Managers	2	18
	Main Total	**432**

Table 5.4.1: The participants from nine colleges chosen from two campuses per college across nine provinces

The sample used in this research is representative; section 5.4.2 covers this sampling method in detail.

5.4.2. Representative sample

The word "representative" suggests that the sample population has similar properties in similar proportions as the population from which it was taken, but in lesser numbers (Welman, Kruger, & Mitchell, 2005). The criteria used allowed TVET colleges to be well represented. Because the findings and recommendations of this study are intended to be of benefit to all public TVET colleges in South Africa it was therefore essential that all provinces be represented including rural, township and urban areas, business and engineering studies, male and female – they all needed to contribute to this study. Representativeness is important in ensuring that results are generalisable.

5.5. Data collection

Data collection is the procedure of putting together and measuring information on targeted variables in a recognised methodical manner, which then allows an individual to respond to applicable questions and for results to be assessed. The data collection part of a study is similar in every field of study including social and physical sciences, business and humanities. The process helps analysts and scientists to obtain key inputs from the collected information. Even though techniques differ by specialisation, the focus on guaranteeing honest and accurate gathering of data does not change. The aim for every data collection is to capture valuable facts and opinions which, when subjected to good data analysis, gives rise to the realisation of a substantial and trustworthy response to the research problem that was raised (McLaughlin, 2016; Sutton & Austin, 2015).

5.5.1. Data collection instrument

The survey used as a data collection instrument is to be found in Annexure A. A survey is a technique used for gathering information; it is capable of gathering information about characteristics of the population, perceived behaviour, awareness of programmes, opinions or attitudes, and needs. Information obtained by means of a survey is important in preparing and evaluating policies and programmes (Queensland Treasury, 2017). Such information gathering is different from a census in which all members of the population participate in the study. A survey was utilised to gain information from just a part of the population concerned. The sample size was determined by the purpose of the research.

For a survey to be statistically valid, the sample needs to be selected objectively in such a way that every member of the population has a non-zero opportunity for selection. Neither should the sample be chosen randomly nor consist of only volunteers. Information/data was obtained using a set of questions in a form of a survey to evaluate the proposed e-learning framework described in Chapter 4, based on the literature review. To ensure effective completion of the surveys, the following processes were followed:

- Surveys were disseminated and collected personally and some were disseminated and completed online;
- Anonymity on the completed surveys was assured;
- The questions were presented in a consistent manner to minimise chances for bias
- The questions in the survey were closed-ended which made it easier to link the replies to each question.

A survey has a number of benefits, a major one being that surveys are cheap and possible responses can be in thousands. Online surveys and mobile surveys are cheaper even in cases where participants receive incentives. Other advantages include that a survey is broad. Surveys are beneficial in determining the features of a big population. Other research methods cannot offer this broad ability, which guarantees an accurate sample to collect targeted outcomes from which to draw conclusions and make essential judgements. Surveys require less time and energy to control and complete. Surveys allow participants to be kept anonymous. To obtain the most accurate data, one needs participants to be open and truthful as much as possible with the replies. Surveys conducted anonymously offer the possibility for truthful and clear responses more than other kinds of research methods, because confidentiality can be maintained. A survey is flexible. Surveys can be conducted in a number of ways, for example email surveys, manual surveys, online surveys, telephone surveys, social media surveys, mobile surveys, and face-to-face interview surveys.

In spite of the survey benefits mentioned above, surveys also have their shortcomings. Participants may inhibit their responses for the sake of pleasing the investigator and as a result valuable information may be lost and responses are usually short.

This survey was designed for college principals, campus managers, subjects' specialists, lecturers, administrators, IT experts and students to evaluate the proposed e-learning framework. The survey consisted of closed-ended questions. The closed-ended questions consisted of pre-determined options (Groves, Fowler,

Couper, Lepkowski, Singer, & Tourangeau, 2009; Shaughnessy, Zechmeister, & Jeanne, 2011). The closed-ended questions were incorporated to save time, making analysis and administration simple (Polit & Hungler, 2004).

The survey was in English as the participants could all read and write English. The survey comprised six sections as indicated in Table 5.5.1:

Survey Sections	Details
Section A: Biographical Information	*collect personal information such as gender, age group, race, occupation, experience and qualification*
Section B: Internet Usage and Availability in Education	*assess internet usage and availability within the college/campus*
Section C: Importance of E-Learning	*check the importance of e-learning*
Section D: Theoretical Foundation of Learning	*evaluate the theoretical foundation of learning*
Section E: Conceptual Technical Building Blocks	*assess the conceptual technical building blocks*
Section F: E-Learning Users' Requirements	*allow participants to contribute on e-learning users' requirements*

Table 5.5.1: Survey sections (find the detailed survey in annexure A)

The participants were assured that their identities would not be disclosed; every response would be anonymous. The information gained from this survey assisted the researcher when analysing the outcomes to understand the characteristics of TVET stakeholders regarding internet usage and availability, the importance of e-learning, the theoretical foundation of learning, the conceptual technical building blocks and e-learning users' requirements for TVET colleges. The research consent form, which included the intention and gains of the research, was attached to the survey to make participants aware of the study purpose.

5.5.2. Data collection procedure

The questionnaire was distributed in person and online to college principals, campus managers, education specialists, IT experts, administrators, lecturers and students to

complete. The data was gathered over a period of two months. The participants were found from the campuses where they reported for duty. For those who could not be met in person, online surveys were distributed and completed online; communication was done telephonically and by e-mail for guidance when necessary. The average time spent to complete each survey was fifteen minutes for both manual and online versions.

5.6. Reliability and validity

It is important for research data to be reliable and valid for it to be usable and of value. However, it is important to be certain that validity and reliability do not get confused. Sections 5.6.1 and 5.6.2 below provide more details on these two aspects.

5.6.1. Reliability

Reliability refers to the consistency of findings. Research can be declared reliable when the research could be conducted several times and produce similar results. Individuals participating in a study who are observing behaviour, or an event should agree on the recorded data for the data to be declared reliable (psc.dss.ucdavis.edu, 2009).

The reliability of the research can be ensured by avoiding bias from data collector and research instrument. In this study various research participants who were surveyed at different times showed consistency in their answers. All the respondents were chosen using criteria set for sample population selection (Polit & Hungler, 2004). The survey was distributed online for participants who could not be reached whether they were unavailable on their campuses where they report for duty or because the researcher could not make it to their campuses but could reach the participants online. The sample criteria were also followed when selecting participants for online surveys.

5.6.2. Validity

Validity is the degree to which a research paper assesses what it aims to assess. Validity comprises two types, namely, internal and external. Internal validity addresses the validity of the measurement and the assessment itself, while external validity addresses the capability to generalise the research conclusions to the target population. Both types are essential in examining the suitability, significance and helpfulness of a research study.

Internal validity was ensured by including questions that were appropriate to the study, questions that helped obtain information that described a suitable e-learning framework for knowledge management in TVET colleges. The questions in the survey included questions that allowed the chosen TVET experts to evaluate and make contributions on the proposed e-learning framework. For the sake of validation, the survey was given to the supervisor and some questions were rephrased to improve their clarity and relevance. Additional suitable response options were added to the closed-ended questions to cater for significant data scrutiny (psucd8.wordpress.com, 2011).

External validity was achieved as this was considered from the early stages of the study and a representative approach for sample selection was followed to allow for generalisation of the outcomes. The findings of the study can be generalised further than the sample used. The individuals requested to take part in the research accepted the request and out of 432, only 339 responded to all the survey questions. A total of 93 participants did not return or complete the surveys (i.e. 24 hard-copy and 69 online). We can therefore declare the study findings to be externally valid. Table 5.6.2 shows the breakdown of participants.

Occupation	Manual survey		Online survey	
	Completed	Not returned	Completed	Not returned
Principalship (Principals or Deputy Principals: Academic)	05	00	03	01
Campus Managers	07	03	05	03
Lecturers and Subject Experts	25	05	66	39
Administrators	19	01	19	06
IT Experts	12	03	26	04
Students	38	12	114	16
TOTAL	106	24	233	69

Table 5.6.2: Breakdown of participants

5.7. Pre-testing the survey

The pre-test refers to an initial test administered to have an idea of a participant's baseline knowledge or readiness for a learning experience or course being studied. It is the advance testing of a research instrument performed before presenting it to its intended sample population (thefreedictionary.com, 2014), and helps to ensure that questions are clear and objective. The survey was pre-tested on five respondents who met the set criteria from two public colleges in KwaZulu-Natal, namely, Mthashana and Majuba TVET colleges. All five respondents replied well to all the questions and the questions were found to be reliable and valid.

5.8. Ethical deliberations

Expertise and diligence are essential when conducting a research study, as well as honesty and integrity. It is necessary to acknowledge and care for the rights of participants. To make sure that this study was conducted in an ethical fashion, the human rights regarding free will, anonymity, secrecy and informed consent were respected. Written permission to conduct research was granted by the Department of Higher Education and Training at Majuba TVET college (see Annexure B). Approval to take part in the research was received before the collection of data. (Shahnazarian, Hagemann, Aburto, & Rose, 2013), defines informed consent as a voluntary agreement to play a part in a research study. This is not just a matter of

signing a form, but is a process where the participants have a clear understanding of the study including its risks.

The participants were knowledgeable about the intention of the research, techniques to be utilised when collecting data and knew that there were no monetary gain or possible risks involved. Anonymity and secrecy were maintained during the course of the study. According to (CUNY, 2012), anonymity means that data collected does not include identifying information of the participants such as name, address, and e-mail address, and cannot be associated with participants' identities with their individual responses. In this research anonymity was preserved by not requesting identifying information from the participants. The ethical principle of free will was also considered. The participants were treated as self-directed individuals by informing them about the research and letting them choose voluntarily whether to take part or not. Queries or complaints were allowed from the participants regarding the researcher. Scientific honesty is considered as an essential ethical responsibility while conducting research.

The manipulation of design and methods together with the retention or manipulations of data are regarded as dishonest conduct (Brink, 2012). Any form of dishonesty was avoided.

5.9. Data analysis

Soon after collecting data it was arranged and scrutinised. The survey consisted of 50 closed-ended questions. The closed-ended questions were analysed using a Microsoft Excel program. Descriptive statistics were utilised to analyse data. The data was presented in pie and bar graphs derived from frequency tables (Trochim, 2006).

5.10. Conclusion

The existing research explored from chapter one to chapter four form part of the qualitative research in this study. We made use of the quantitative survey as a data

collection instrument. The survey was administered by an investigator to gather the data from a representative sample of 432 participants. The survey comprised of the closed-ended questions. The sample consisted of adults who were TVET college experts, comprising college principals, campus managers, subjects' specialists or lecturers, IT experts, administrators and students. Authorisation to conduct the research was obtained from the Department of Higher Education and Training which governs all public TVET colleges. Consent was obtained from the participants. Anonymity, free will and confidentiality were guaranteed while administering the survey and writing of the report. The surveys were disseminated personally to participants by the researcher to make sure validity was achieved. Reliability and validity were further improved by executing pretesting of the survey.

The research methodology has been described in this chapter, together with the population, sample, data collection instrument and tactics used to safeguard the reliability, validity and ethical standards of the study.

The data analysis and results of the collected data is presented in the next chapter.

6. Data Analysis and Results

6.1. Introduction

This chapter presents data analysis and results from 339 questionnaires completed by TVET stakeholders who participated in the survey including, among others: principals, campus managers, lecturers / subject specialists, administrators, IT experts and students from nine participating colleges in nine provinces across South Africa. The main objective of this study was to develop an e-learning framework for KM in TVET colleges.

The main objective of the survey was to fulfil the fourth sub-objective of this dissertation which is the evaluation and validation of the framework suggested in Chapter 4. The specific objective of the survey was to achieve the following through the analysis of collected data:

Assess internet usage and availability within the college/campus in order to establish an understanding of the challenges faced by TVET stakeholders with regard to the availability of internet connectivity in their respective geographical environments.

Check the importance of e-learning to ascertain that e-learning could indeed be consider as a powerful instrument aimed at overcoming existing challenges in the traditional face-to-face learning approach.

Evaluate the theoretical foundations of learning in order to confirm its strategic importance in drafting KS instruments needed for a successful and resourceful e-learning process.

Assess the conceptual technical building blocks in order to check the importance of KS principles to ensure that they are incorporated into an e-learning framework for the system to meet the stakeholders' needs, especially the learners.

Allow participants to contribute to e-learning users' requirements for the purpose of developing a prototype that meets stakeholders' needs for a better user experience in a real-life scenario.

This chapter presents the views of the respondents in tables and charts in relation to all the questions in the survey which is followed by an analysis of what the results imply. This chapter is presented in sections and sub-sections according to the survey questions.

6.2. The survey

The survey questionnaire consisted of 50 closed-ended questions which were distributed manually and online. The surveys were given to TVET stakeholders aged 18 years or older. The consent form was attached to the survey indicating that it was the participant's choice to contribute. The form also stated clearly that participant's contributions would be anonymous meaning that no identifying information would be linked with the contributions made. A total of 432 surveys were distributed, 130 manually and 302 online. Three hundred and thirty nine TVET stakeholders completed the surveys in which 106 were manual and 233 were completed online giving a response rate of 78.47%. The causes for refusal to participate and the characteristics of the non-respondents are not known. The closed-ended questions were analysed using a Microsoft Excel program. Descriptive statistics were utilised to analyse data. The data was presented in pie and bar graphs derived from frequency tables (Trochim, 2006).

6.3. Section A: Biographical information

This section of the survey included the participants' gender, age group, occupation, experience, qualification and campus location. As much as this information is not central to the research, this kind of personal information helped to contextualise the results and the preparation of suitable recommendations to provide TVET colleges with a substantial e-learning framework.

6.3.1. Gender

Occupation	Female		Male		Total	
Principal	1	12.5%	7	87.5%	8	100%
Campus Manager	4	33.3%	8	66.7%	12	100%
Lecturer / Subject Specialist	53	58.2%	38	41.8%	91	100%
Administrator	27	71.1%	11	28.9%	38	100%
IT Expert	7	18.4%	31	81.6%	38	100%
Student	79	52.0%	73	48.0%	152	100%
Total	171	50.4%	168	49.6%	339	100%

Table 6.3.1: Gender of the participants

The participants were requested to indicate their gender by selecting the relevant option provided (Female or Male). Responses indicated that 171 (50.44%) were female and 168 (49.56) were male as shown in Table 6.3.1 and Figure 6.3.1-1.

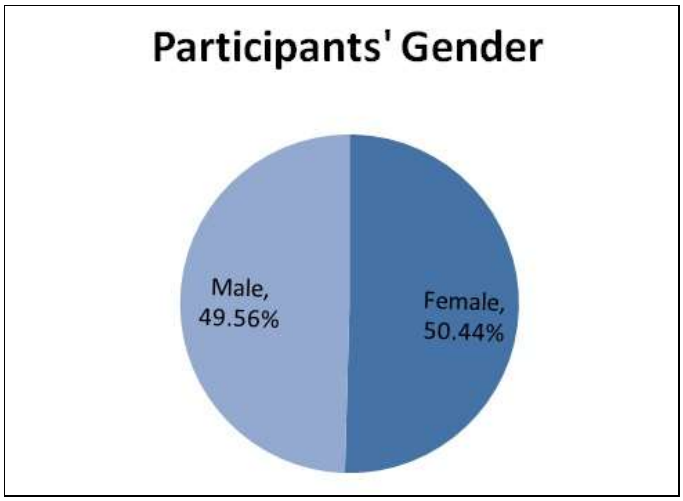

Figure 6.3.1-1: Participants' gender

However, as can be seen from Figure 6.3.1-2, senior positions such as principals, campus managers and IT experts were dominated by males (87.50%, 66.67% and 81.58% respectively).

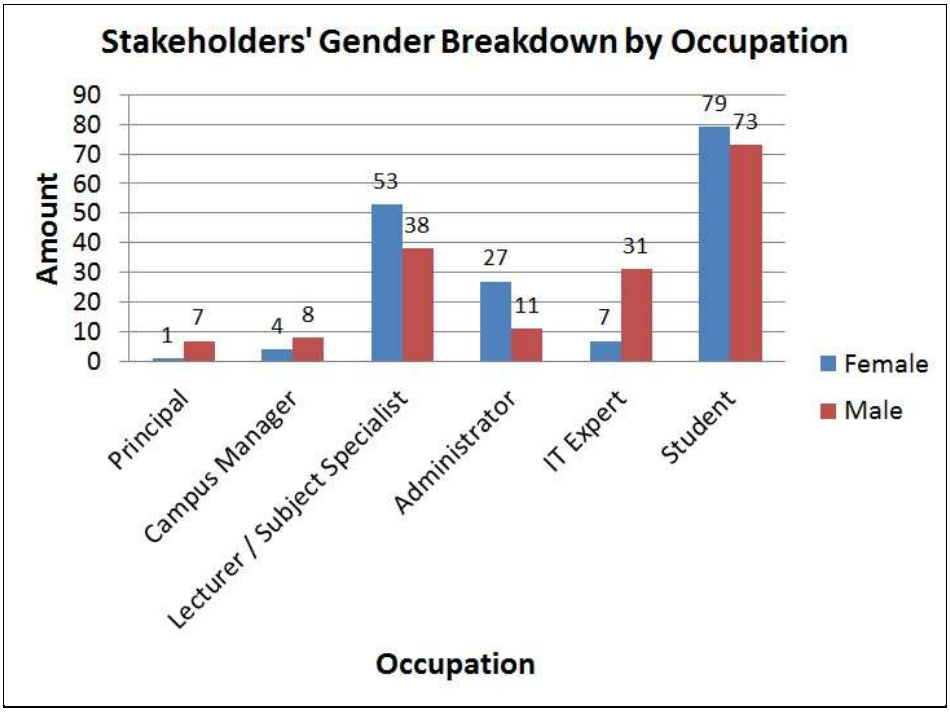

Figure 6.3.1-2: Gender breakdown by occupation

6.3.2. Age

Occupation	18 – 25	%	26 – 35	%	36 – 45	%	46 – 55	%	56 – 65	%	> 65	%
Principal	0	0	0	0	0	0	3	0.9	5	1.5	0	0
Campus Manager	0	0	1	0.3	3	0.9	5	1.5	3	0.9	0	0
Lecturer / Subject Specialist	5	1.5	27	8.0	22	6.5	26	7.7	11	3.2	0	0
Administrator	12	3.5	8	2.4	11	3.2	5	1.5	2	0.6	0	0
IT Expert	8	2.4	24	7.1	6	1.8	0	0	0	0	0	0
Student	113	33.3	36	10.6	3	0.9	0	0	0	0	0	0
	138	40.7	96	28.3	45	13.3	39	11.5	21	6.2	0	0

Table 6.3.2: The age group of the participants

As can be seen from Table 6.3.2, the majority of participants belong to the 18 to 25 year old age-group (138, 40.71%) with most of these being students (113, 33.33%). The smallest age-group was 56 to 65 with 21 (6.19%) made up of principals (5, 1.47%), campus managers (3, 0.88%), lecturers / subject specialists (11, 3.24%) and administrators (2, 0.59%).

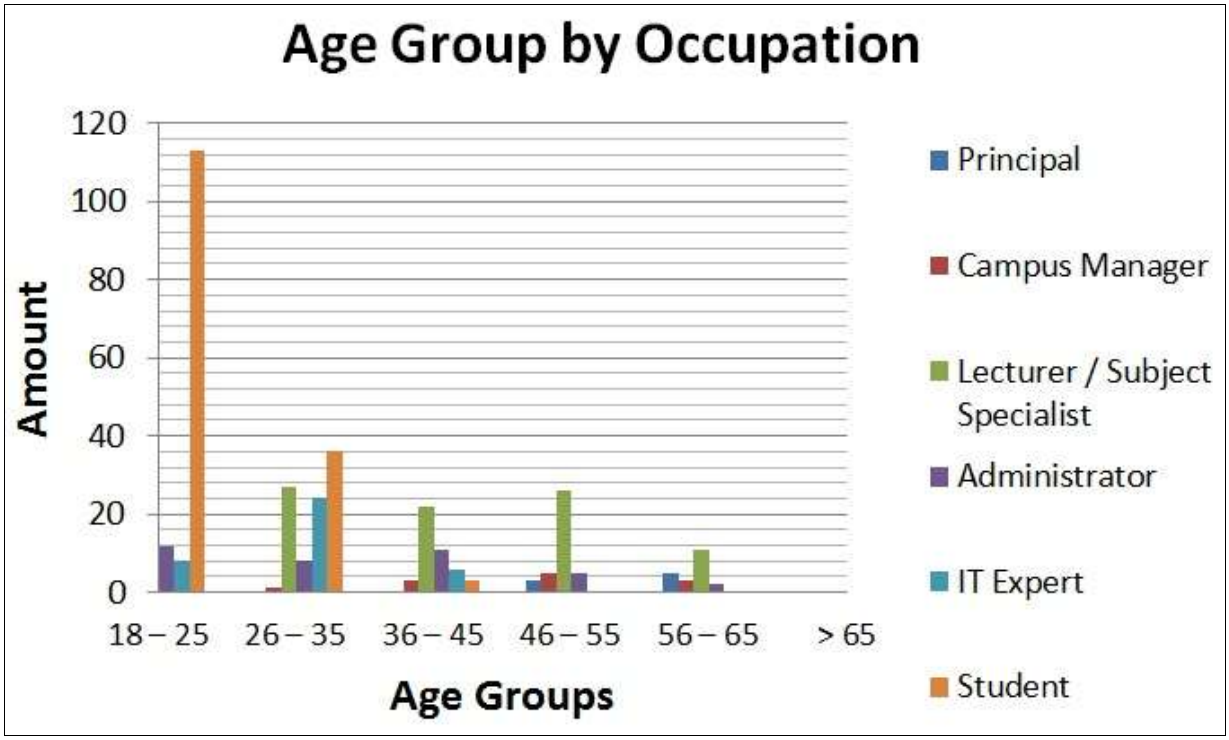

Figure 6.3.2: Age group by occupation

6.3.3. Position held

College name	Principal	%	Campus manager	%	Subject specialist/ lecturer	%	Admin	%	IT expert	%	student	%	Total per college
Majuba	1	2%	2	5%	11	26%	5	12%	5	12%	18	43%	42
Ehlanzeni	1	3%	2	6%	9	26%	5	26%	3	9%	15	43%	35
West Coast	1	2%	2	5%	12	28%	4	28%	5	12%	19	44%	43
Buffalo City	1	3%	1	3%	10	28%	4	28%	4	11%	16	44%	36
Maluti	1	3%	1	3%	13	33%	3	33%	3	8%	18	46%	39
Sedibeng	1	3%	1	3%	8	25%	3	25%	5	16%	14	44%	32
Vhembe	1	3%	1	3%	11	28%	4	28%	5	13%	17	44%	39
Northern Cape Rural	1	3%	1	3%	9	24%	5	24%	5	14%	16	43%	37
Vuselela	0	0%	1	3%	8	22%	5	22%	3	8%	19	53%	36
													339

Table 6.3.3: The participants by occupation per college

The participants were requested to indicate their position held by selecting the relevant option provided (principal, campus manager, lecturer, subject specialist, administrator, IT expert or student) (Table 6.3.3 and Figure 6.3.3). The majority of

the participants were students (152, 44.84%) and most of them were aged from 18 to 25 (113, 33.33%) with an average of 16.89 (4.98%) per college.

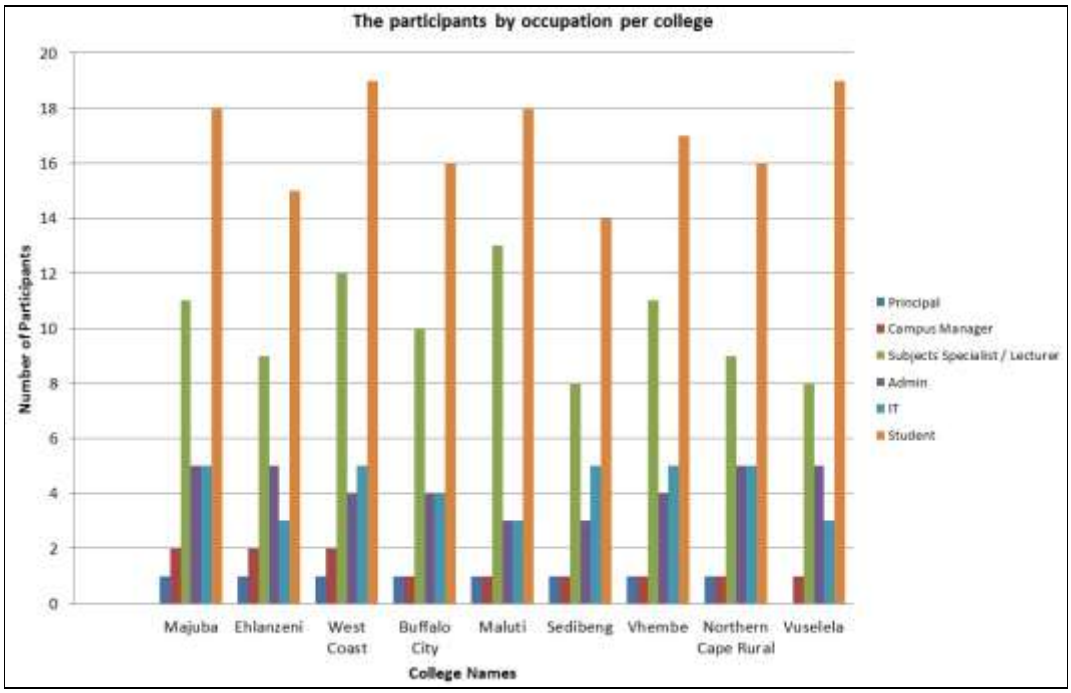

Figure 6.3.3: The participants by occupation per college

The administrators and IT experts were the smallest group with 38 (11.21%) each.

6.3.4. Number of years in the organisation

Occupation	0 – 5	%	6 – 10	%	11 - 15	%	16 – 20	%	21 – 25	%	Over 25	%
Principal	0	0	1	0.3	1	0.3	5	1.5	1	0.3	0	0
Campus Manager	0	0	0	0	2	0.6	4	1.2	6	1.8	0	0
Lecturer / Subject Specialist	19	5.6	39	11.5	12	3.5	8	2.4	13	3.8	0	0
Administrator	13	3.8	11	3.2	5	1.5	6	1.8	3	0.9	0	0
IT Expert	9	2.7	14	4.1	8	2.4	7	2.1	0	0.0	0	0
Student	136	40.1	16	4.7	0	0.0	0	0.0	0	0.0	0	0
Total	177	52.2	81	23.9	28	8.3	30	8.8	23	6.8	0	0

Table 6.3.4: The service length of the participants per college

The participants were requested to indicate their position held by selecting the relevant option provided (0 – 5, 6 – 10, 11 – 15, 16 – 20, 21 – 25 or over 25). As can be seen from Table 6.3.4 and Figure 6.3.4, the majority of the participants (177,

52.21%) had been with an institution for 0 – 5 years and most of them were students (136, 40.12%). No participant had been with their institution for over 25 years.

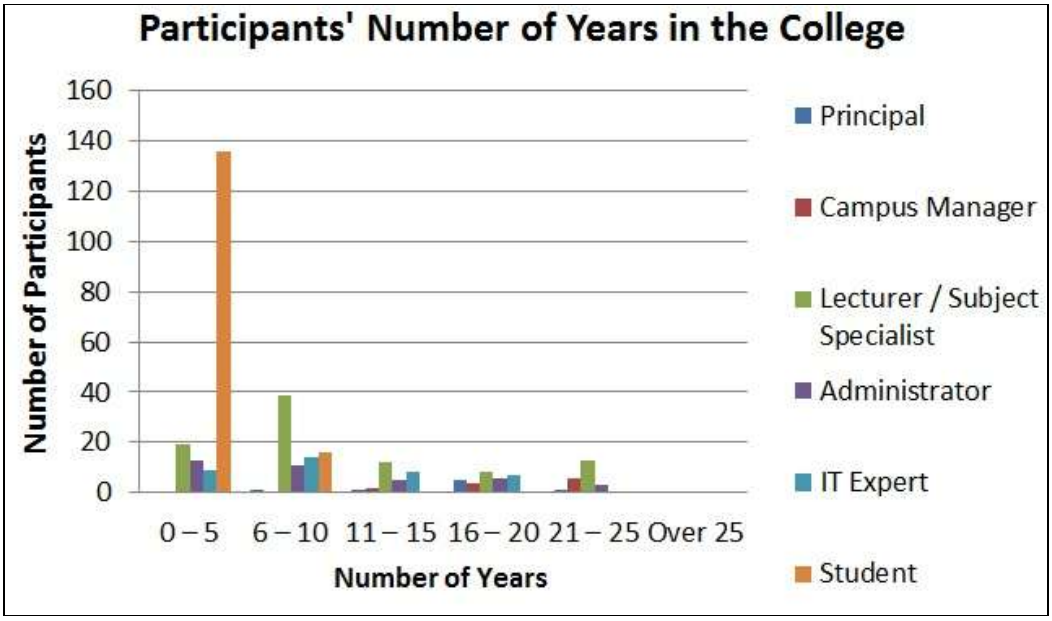

Figure 6.3.4: Number of years in the college

6.3.5. Highest qualification

Occupation	Gr 9	%	Gr 10	%	Gr 11	%	Gr 12	%	H.Cert	%	Dipl	%	Degr	%	Hons	%	Mast	%	PhD	%
Principal	0	0	0	0	0	0	0	0	0	0	1	0.3	2	0.6	3	0.9	2	0.6	0	0
Campus Manager	0	0	0	0	0	0	0	0	0	0	1	0.3	3	0.9	7	2.1	1	0.3	0	0
Lecturer / Subject Specialist	0	0	0	0	0	0	0	0	0	0	44	13.0	32	9.4	9	2.7	6	1.8	0	0
Administrator	0	0	0	0	0	0	0	0	12	3.5	19	5.6	5	1.5	2	0.6	0	0	0	0
IT Expert	0	0	0	0	0	0	0	0	28	8.3	7	2.1	3	0.9	0	0	0	0	0	0
Student	22	6.5	13	3.8	18	5.3	84	24.8	8	2.4	4	1.2	3	0.9	0	0	0	0	0	0
Total	22	6.5	13	3.8	18	5.3	84	24.8	48	14.2	76	22.4	48	14.2	21	6.2	9	2.7	0	0

Table 6.3.5: The qualification of the participants per occupation

The participants were requested to indicate their highest qualification by selecting the relevant option provided (Gr 9, Gr 10, Gr 11, Gr 12, H. Cert, Dipl, Degr, Hons, Mast or PhD). As can be seen from Table 6.3.5 and Figure 6.3.5, the majority of the participants were students and in possession of Grade 12 (84, 24.78%) which indicates that most TVET students are in possession of Grade 12. The IT experts' qualifications range from higher certificate to a degree while the administration personnel range from higher certificate to honours.

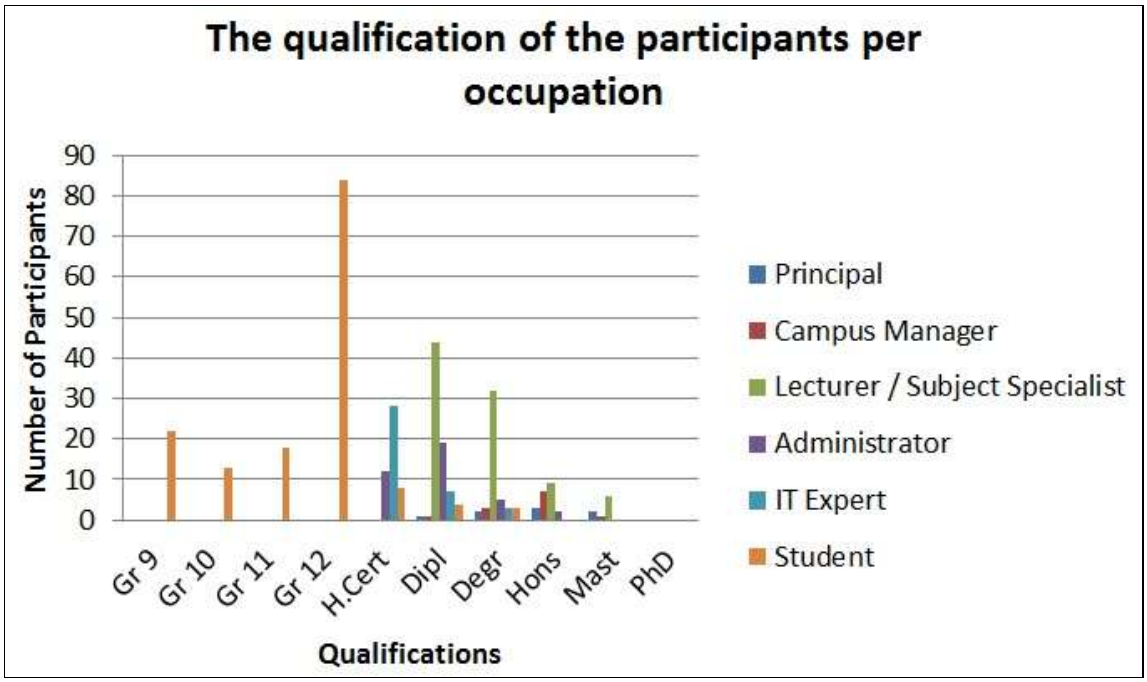

Figure 6.3.5: Qualifications per occupation

Principal, campus manager and lecturer / subject specialist qualifications range from diploma to masters with the majority of lecturers / subject specialists in possession of a diploma (44, 13%). None of the participants had a PhD qualification.

6.3.6. The area where the campus is located

Occupation	Urban	%	Township	%	Rural	%
Principal	4	1.2%	4	1.2%	0	0%
Campus Manager	4	1.2%	8	2.4%	0	0%
Lecturer / Subject Specialist	48	14.2%	43	12.7%	0	0%
Administrator	18	5.3%	20	5.9%	0	0%
IT Expert	20	5.9%	18	5.3%	0	0%
Student	79	23.3	73	21.5%	0	0%
Total	173	51.03%	166	48.97%	0	0%

Table 6.3.6: Campus location of participants

The participants were requested to indicate their campus location by selecting the relevant option provided (Urban, Township or Rural).

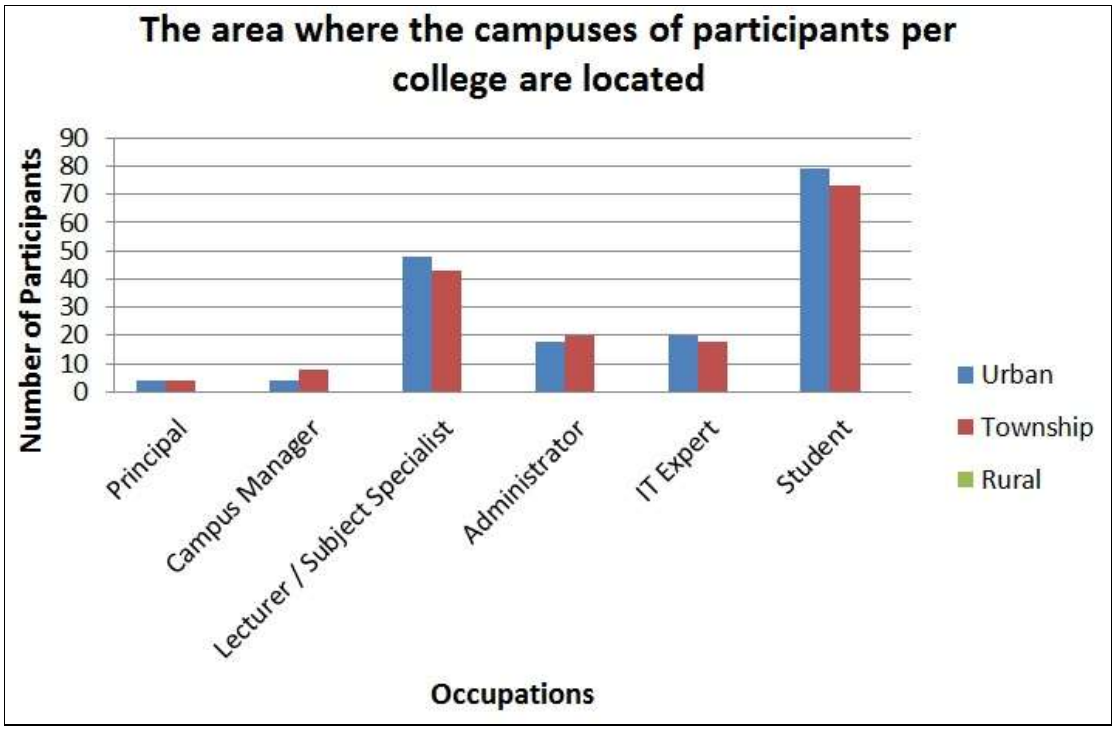

Figure 6.3.6: Campus location of participants

Table 6.3.6 and Figure 6.3.6 show that the majority of participants were located on campuses in urban areas (173, 51.03%), followed by township areas (166, 48.97%) and none were on campuses located in rural areas.

6.4. Section B: Internet usage and availability in education

This section of the survey sought to assess internet usage and availability within the college/campus in order to establish an understanding of the difficulties faced by TVET stakeholders with regard to the availability of internet connectivity in their respective geographical environments.

6.4.1. Learning should be offered to students using internet as a platform[1]

Occupation	Strongly agree	%	Agree	%	Not Sure	%	Disagree	%	Strongly disagree	%
Principal	4	1.2%	4	1.2%	0	0%	0	0%	0	0%
Campus Manager	0	0%	12	3.5%	0	0%	0	0%	0	0%
Lecturer / Subject Specialist	27	8.0%	49	14.5%	12	3.5%	3	0.9%	0	0%
Administrator	12	3.5%	14	4.1%	7	2.1%	5	1.5%	0	0%
IT Expert	17	5.0%	16	4.7%	5	1.5%	0	0%	0	0%
Student	22	6.5%	88	26.0%	29	8.6%	13	3.8%	0	0%
Total	82	24.2%	183	54.0%	53	15.6%	21	6.2%	0	0%

Table 6.4.1: Views about offering learning by means of the internet

The participants were requested to indicate if they believe in offering learning to students using the internet as a platform by selecting the relevant option provided (Strongly agree, Agree, Not Sure, Disagree or Strongly disagree). As can be seen from Table 6.4.1 and Figure 6.4.1, all the principals and campus managers (100%) supported learning using the internet as a platform, regardless of their gender, age, experience, qualification and area where the campuses were located, which shows that TVET management is open to technology and understand the benefits which the internet may offer. Ninety-one lecturers / subject specialists participated in this study, 76 (84%) of whom agreed with the use of the internet as a learning platform. Twelve (13%) of these participants were not sure which indicated doubt which may be caused by lack of internet knowledge, ignorance or resistance to change, and three (3%) of them disagreed which could indicate that they do not believe that using the internet as a learning platform is capable of helping students achieve their learning objectives, or be due to resistance to change or/and lack of understanding of the benefits that the internet has to offer.

The lecturers / subject specialists who were not sure comprised nine participants aged 56 to 65, two participants aged 46 to 55 and one aged 36 to 45 which makes it clear that age is a contributing factor when it comes to selection of the learning platform.

[1] The wording of subheadings reflect the exact wording of the survey questions

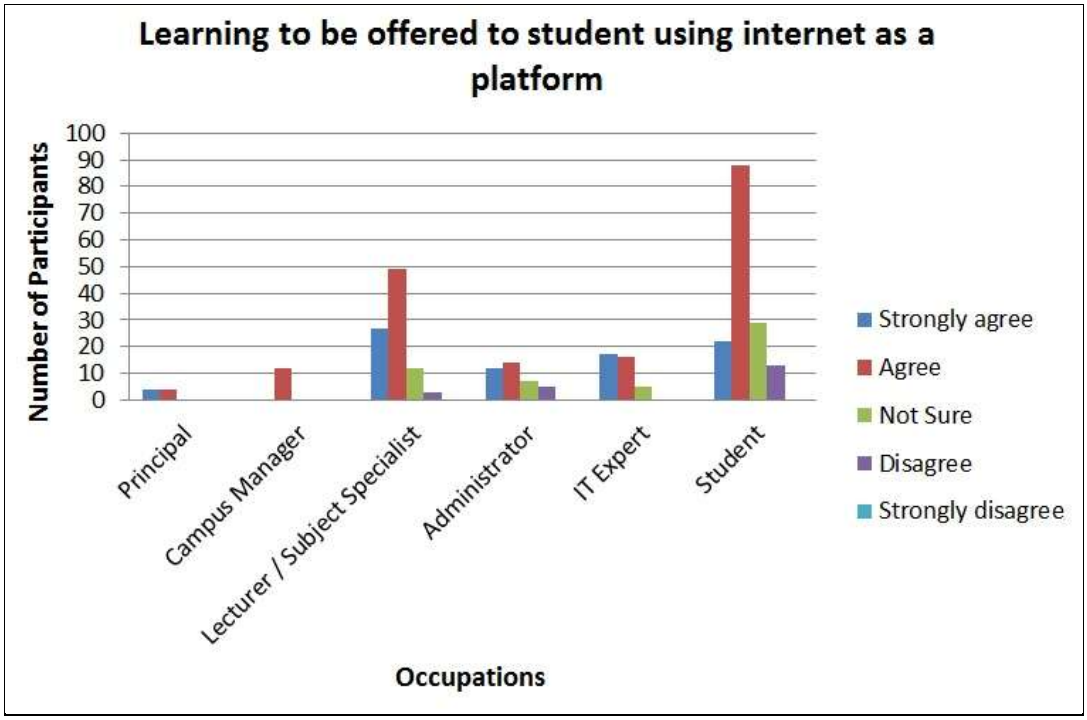

Figure 6.4.1: Views about offering learning by means of the internet

Most respondents (265, 78%) believed that the internet should be used as a learning platform. The data collected supports the view of (Asmal, 2003) who states that the world is changing, and ICT is significant to the transformation. Computerised means of communication have modernised the way people exchange information.

6.4.2. How good is internet in terms of connectivity and speed?

Occupation	Very good	%	Good	%	Not Sure	%	Poor	%	Very poor	%
Principal	0	0%	8	2.4%	0	0%	0	0%	0	0%
Campus Manager	0	0%	6	1.8%	1	0.3	5	1.5%	0	0%
Lecturer / Subject Specialist	0	0%	18	5.3%	22	6.5%	51	15.0%	0	0%
Administrator	0	0%	12	3.5%	5	1.5%	21	6.2%	0	0%
IT Expert	0	0%	11	3.2%	0	0%	27	8.0%	0	0%
Student	0	0%	17	5.0%	9	2.7%	126	37.2%	0	0%
Total	0	0%	72	21.2%	37	10.9%	230	67.8%	0	0%

Table 6.4.2: Internet connectivity and speed

The participants were requested to indicate how good was the internet connectivity and speed they had access to, by selecting the relevant option provided (Very good, Good, Not Sure, Poor or Very poor). As can be seen from Table 6.4.2 and Figure 6.4.2, internet connectivity and speed was poor on most campuses according to most of the respondents (230, 67.8%), while (72, 21.2%) reported internet connectivity and speed to be of good quality and (37, 10.9%) were unsure. This is an indication that internet connectivity and speed needs to be improved on most campuses for TVET to adopt e-learning.

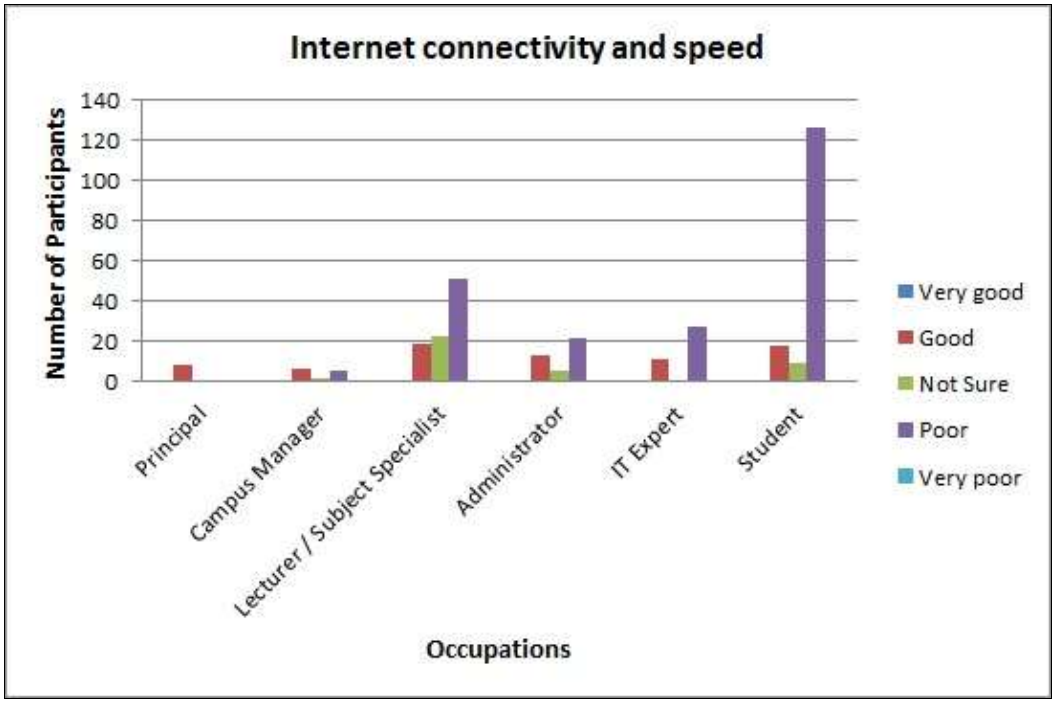

Figure 6.4.2: Internet connectivity and speed

The data collected show that there is no distinction between campuses in urban and township areas with regards to internet quality. The (Department of Education, 2003), indicates that the delivery of a telecommunication infrastructure for the purpose of teaching and learning is increasing, and various colleges are exploiting the gains of ICT to improve the value of teaching. The participants do acknowledge that telecommunication (network) infrastructure is available. However, respondents indicate that network infrastructure on most colleges/campuses is of poor quality.

6.4.3. How accessible is the internet to the staff of the TVET?

Occupation	Internet room	%	Mobile device	%	Laptop	%	Wi-Fi	%	None	%	Not Sure	%
Principal	8	2.4	0	0	0	0	0	0	0	0	0	0
Campus Manager	11	3.2	0	0	0	0	1	0.3	0	0	0	0
Lecturer / Subject Specialist	48	14.2	22	6.5	13	3.8	8	2.4	0	0	0	0
Administrator	17	5.0	6	1.8	10	2.9	0	0	0	0	5	1.5
IT Expert	19	5.6	14	4.1	3	0.9	2	0.6	0	0	0	0
Student	97	28.6	17	5.0	18	5.3	4	1.2	0	0	16	4.7
Total	200	59.0	59	17.4	44	13.0	15	4.4	0	0	21	6.2

Table 6.4.3: How staff access the internet

The participants were requested to indicate how staff access the internet by selecting the relevant option provided (Internet room, Mobile device, Laptop, Wi-Fi, None or Not Sure). As can be seen from Table 6.4.3 and Figure 6.4.3, most staff access the internet through the internet room which include offices (200, 59%), followed by mobile device (59, 17.4%), laptop (44, 13.0%), Wi-Fi (15, 4.4%) and (21, 6.2%) were unsure.

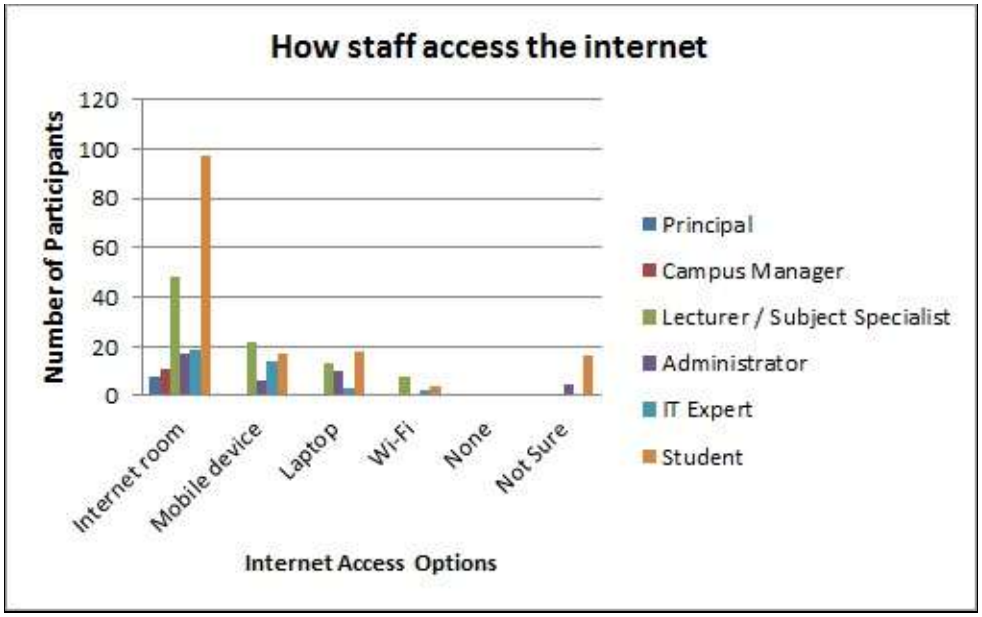

Figure 6.4.3: How staff access the internet

These results indicate that the majority of staff access the internet via the internet room or/and office together with Wi-Fi which is based on the campus. The few who

are using mobile devices or/and laptops would not be limited by the geographic location as they can carry their device wherever they go both within and beyond the campus.

6.4.4. How accessible is the internet to students of the TVET

Occupation	Internet room	%	Mobile device	%	Laptop	%	Wi-Fi	%	None	%	Not Sure	%
Principal	8	2.4	0	0	0	0	0	0	0	0	0	0
Campus Manager	11	3.2	0	0	0	0	1	0.3	0	0	0	0
Lecturer / Subject Specialist	48	14.2	22	6.5	13	3.8	8	2.4	0	0	0	0
Administrator	17	5.0	6	1.8	10	33.9	0	0	0	0	5	1.5
IT Expert	19	5.6	14	4.1	3	0.9	2	0.6	0	0	0	0
Student	97	28.6	17	5.0	18	5.3	4	1.2	0	0	16	4.7
Total	200	59.0	59	17.4	44	13.0	15	4.4	0	0	21	6.2

Table 6.4.4: How students access the internet

The participants were requested to indicate how students access the internet by selecting the relevant option provided (Internet room, Mobile device, Laptop, Wi-Fi, None or Not Sure). The data collected on how students access the internet were similar to that of how staff access the internet. As can be seen from Table 6.4.4 and Figure 6.4.4, most students access the internet through the internet room (200, 59%), followed by mobile device (59, 17.4%), laptop (44, 13.0%), Wi-Fi (15, 4.4%) and 21 (6.2%) were unsure. This is an indication that the majority of students access the internet at the campus internet room together with Wi-Fi which is based at the campus.

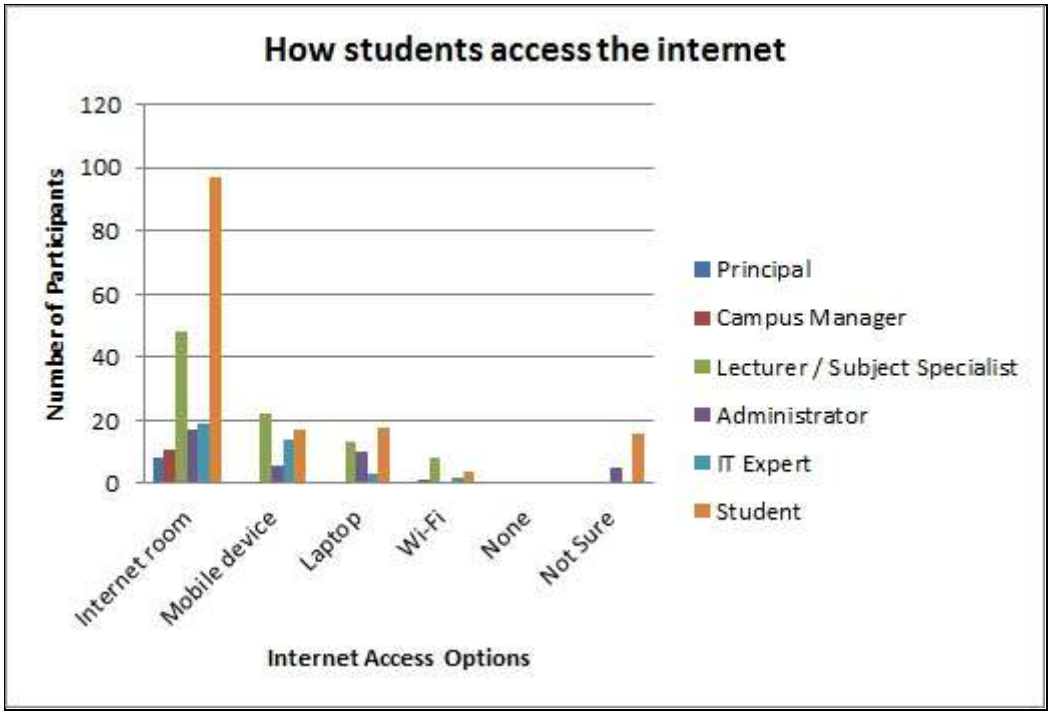

Figure 6.4.4: How students access the internet

The few who are using mobile devices or/and laptops are not limited by the geographic location as they may carry their device wherever they go both within and beyond campus.

6.5. Section C: Importance of e-learning

This section of the survey aimed to check the importance of e-learning in order to ascertain that e-learning could indeed be considered as a powerful instrument aimed at overcoming existing challenges in the traditional face-to-face learning approach. The questions in this section were designed to indicate whether e-learning is a suitable mechanism to overcome challenges faced by TVETs with regard to KS.

6.5.1. What other learning practices do you have besides normal face-to-face learning?

Occupation	Social media	E-learning	Both	None	%
Principal	0	0	0	8	2.4
Campus Manager	0	0	0	12	3.5
Lecturer / Subject Specialist	0	0	0	91	26.8
Administrator	0	0	0	38	11.2
IT Expert	0	0	0	38	11.2
Student	0	0	0	152	44.8
Total	0	0	0	339	100.0

Table 6.5.1: Other learning practices besides normal face-to-face learning

The participants were requested to indicate what other learning practices besides normal face-to-face learning they engaged in by selecting the relevant option provided (Social media, E-learning, Both or None). As can be clearly seen from Table 6.5.1 and Figure 6.5.1, none of the respondents engaged in an alternative learning practice (s) besides normal face-to-face learning. All participants (100%) chose "None" as their answer in this question. According to (Henry, 2007), the main disadvantage of the traditional face-to-face mode is that students cannot gain or share knowledge if for some reason they cannot make it to the college.

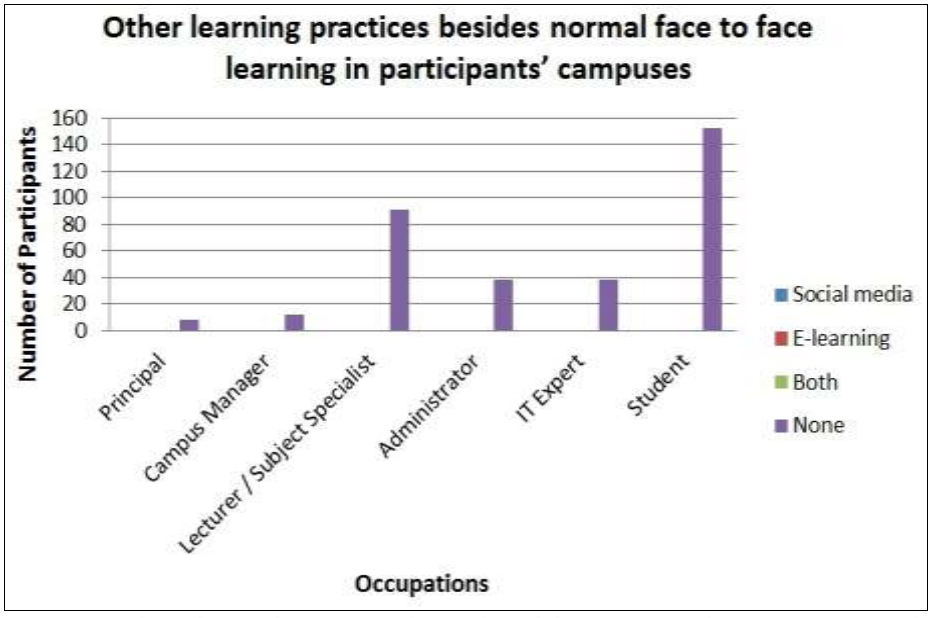

Figure 6.5.1: Other learning practices besides normal face-to-face learning

The data collected indicate that TVET colleges represented in this study face the challenge that students cannot gain or share knowledge if they cannot get to the college.

6.5.2. How effective is the alternative learning approach beside face-to-face?

Occupation	Very good	%	Good	%	Does not exist	%	Poor	%	Very poor	%
Principal	0	0	0	0	8	2.4	0	0	0	0
Campus Manager	0	0	0	0	12	3.5	0	0	0	0
Lecturer / Subject Specialist	0	0	0	0	91	26.8	0	0	0	0
Administrator	0	0	0	0	38	11.2	0	0	0	0
IT Expert	0	0	0	0	38	11.2	0	0	0	0
Student	0	0	0	0	152	44.8	0	0	0	0
Total	0	0	0	0	339	100.0	0	0	0	0

Table 6.5.2: Effectiveness of alternative learning approaches

Participants were requested to indicate an effectiveness of alternative learning approaches (i.e. non-face-to-face approaches) by selecting the relevant option provided (Very good, Good, Does not exist, Poor or Very poor). None of the participating colleges/campuses have alternative learning practice besides face-to-face, therefore all participants (100%) chose “Does not exist” as their answer to this question (See Table 6.5.2 and Figure 6.5.2).

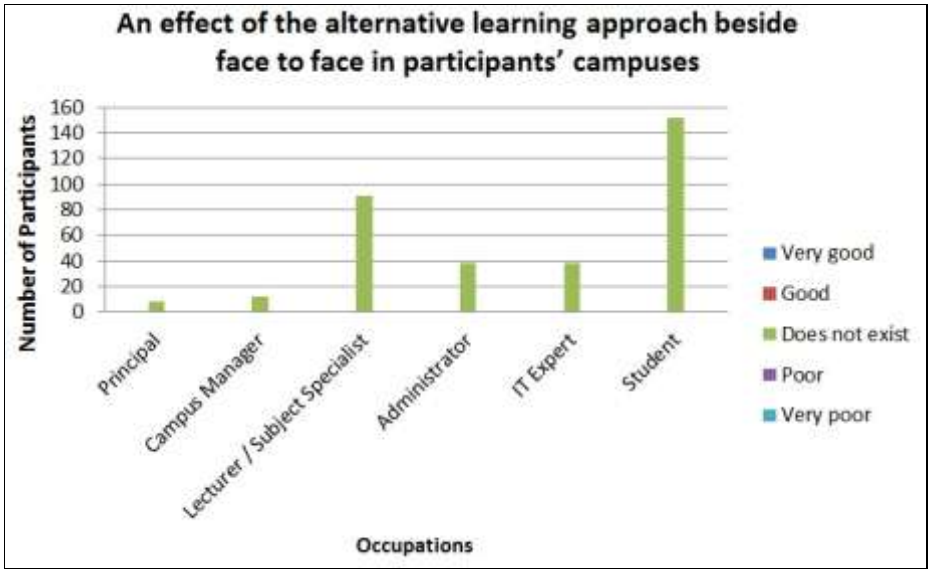

Figure 6.5.2: Effectiveness of alternative learning approaches

6.5.3. How widely spread is the approach beside face-to-face?

The participants were requested to indicate how wide-spread alternative approaches were by selecting the relevant option provided (Very good, Good, Does not exist, Poor or Very poor).

Occupation	Very good	%	Good	%	Does not exist	%	Poor	%	Very poor	%
Principal	0	0	0	0	8	2.4	0	0	0	0
Campus Manager	0	0	0	0	12	3.5	0	0	0	0
Lecturer / Subject Specialist	0	0	0	0	91	26.8	0	0	0	0
Administrator	0	0	0	0	38	11.2	0	0	0	0
IT Expert	0	0	0	0	38	11.2	0	0	0	0
Student	0	0	0	0	152	44.8	0	0	0	0
Total	0	0	0	0	339	100.0	0	0	0	0

Table 6.5.3: How wide-spread are the alternative approaches

As can be seen from Table 6.5.3 and Figure 6.5.3, all participants (100%) indicated that alternative approaches do not exist.

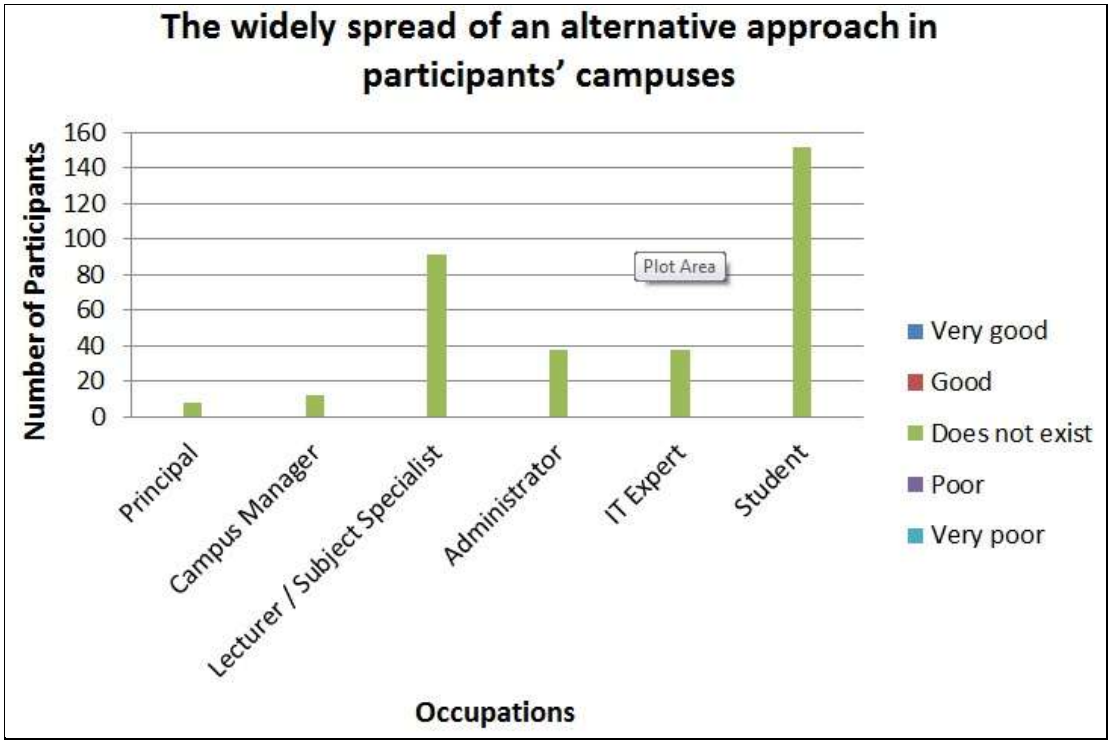

Figure 6.5.3: How wide-spread are the alternative approaches

6.5.4. Would you consider e-learning as a complement to face-to-face?

Occupation	Strongly agree	%	Agree	%	Not sure	%	Disagree	%	Strongly disagree	%
Principal	4	1.2	4	1.2	0	0	0	0	0	0
Campus Manager	10	2.9	2	0.6	0	0	0	0	0	0
Lecturer / Subject Specialist	74	21.8	12	3.5	5	1.5	0	0	0	0
Administrator	14	4.1	16	4.7	8	2.4	0	0	0	0
IT Expert	25	7.4	13	3.8	0	0	0	0	0	0
Student	77	22.7	51	15.0	24	7.1	0	0	0	0
Total	204	60.2	98	28.9	37	10.9	0	0	0	0

Table 6.5.4: Consideration of e-learning as complementary to face-to-face learning

The participants were requested to indicate if they consider e-learning to be complementary to face-to-face learning by selecting the relevant option provided (Strongly agree, Agree, Not sure, Disagree or Strongly disagree). As can be seen from Table 6.5.4. and Figure 6.5.4., the majority of participants (302, 89.1%) considered e-learning to be complementary to face-to-face learning in order to extend access to learning whenever face-to-face is unavailable. Only (37, 10.9%) indicated that they were unsure.

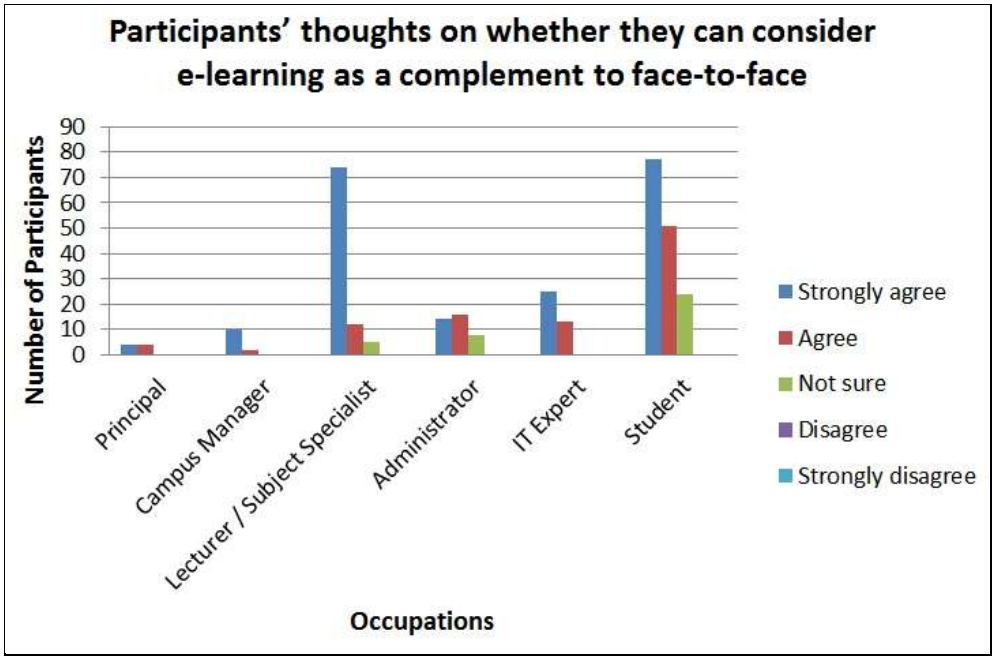

Figure 6.5.4: Consideration of e-learning as complementary to face-to-face learning

6.5.5. Would you consider e-learning as an alternative to face-to-face?

Occupation	Strongly agree	%	Agree	%	Not sure	%	Disagree	%	Strongly disagree	%
Principal	0	0	0	0	0	0	8	2.4	0	0
Campus Manager	0	0	0	0	0	0	10	2.9	2	0.6
Lecturer / Subject Specialist	0	0	0	0	5	1.5	86	25.4	0	0
Administrator	0	0	0	0	6	1.8	28	8.3	4	1.2
IT Expert	0	0	0	0	10	2.9	25	7.4	3	0.9
Student	0	0	0	0	28	8.3	124	36.6	0	0
Total	0	0	0	0	49	14.5	281	82.9	9	2.7

Table 6.5.5: Consideration of e-learning as an alternative to face-to-face learning

The participants were requested to indicate whether they considered e-learning to be an alternative to face-to-face by selecting the relevant option provided (Strongly agree, Agree, Not sure, Disagree or Strongly disagree). As can be seen from Table 6.5.5 and Figure 6.5.5, the majority of participants (290, 85.5%) did not consider e-learning to be an alternative (replacement) to face-to-face learning. Only (49, 14.5%) indicated that they were unsure.

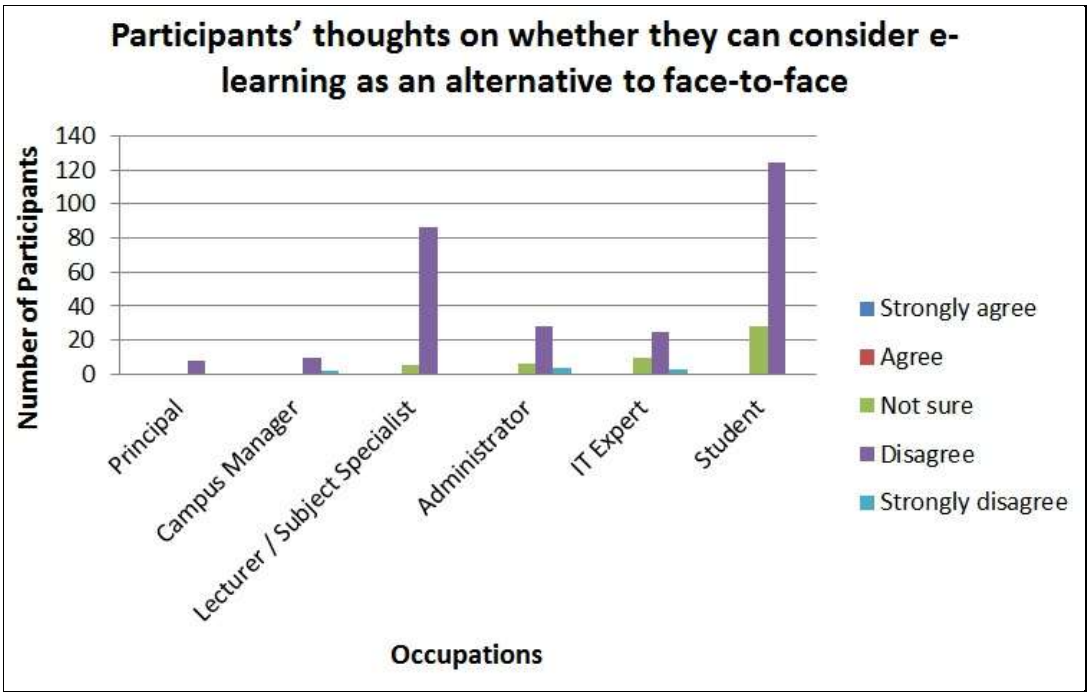

Figure 6.5.5: Consideration of e-learning as an alternative to face-to-face learning

6.5.6. Would you consider e-learning as a coexisting approach for enhanced handing over?

Occupation	Strongly agree	%	Agree	%	Not sure	%	Disagree	%	Strongly disagree	%
Principal	0	0	0	0	2	0.6	6	1.8	0	0
Campus Manager	0	0	0	0	4	1.2	8	2.4	0	0
Lecturer / Subject Specialist	0	0	10	2.9	15	4.4	66	19.5	0	0
Administrator	0	0	0	0	6	1.8	24	7.1	8	2.4
IT Expert	0	0	0	0	5	1.5	31	9.1	2	0.6
Student	0	0	15	4.4	77	22.7	53	15.6	7	2.1
Total	0	0	25	7.4	109	32.2	188	55.5	17	5.0

Table 6.5.6: Consideration of e-learning as a coexisting approach for enhanced handing over

The participants were requested to indicate if they considered e-learning to be a coexisting approach for enhanced handing over by selecting the relevant option provided (Strongly agree, Agree, Not sure, Disagree or Strongly disagree). As can be seen from Table 6.5.6 and Figure 6.5.6, the majority of participants (205, 60.5%) did not consider e-learning as a coexisting approach for enhanced handing over.

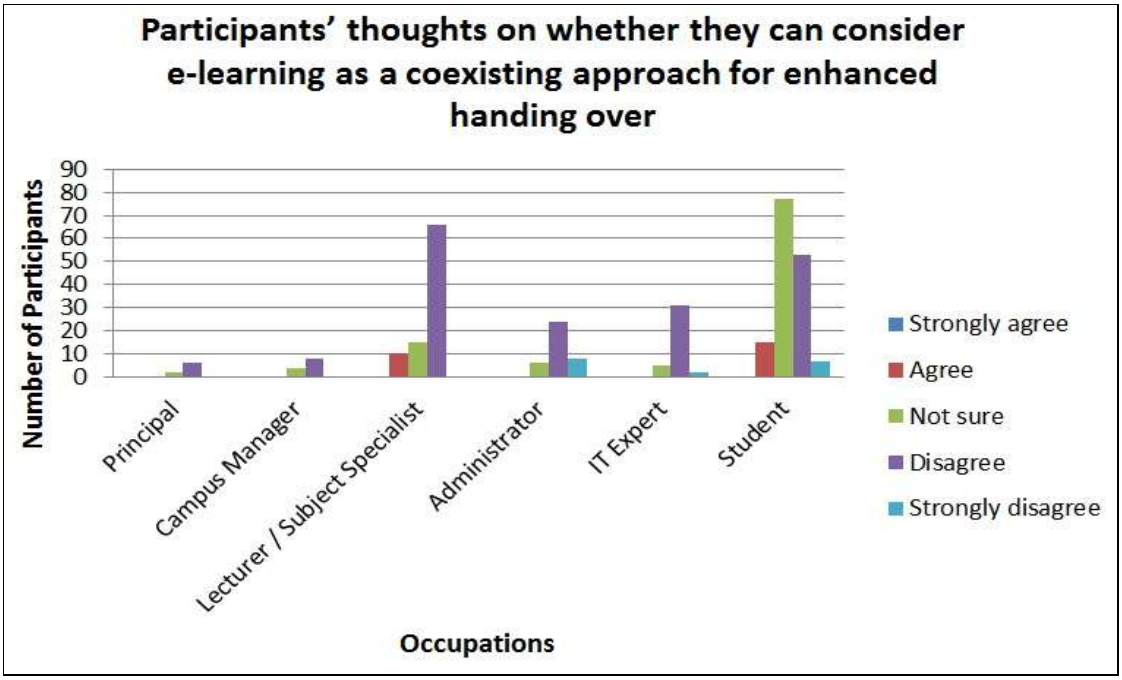

Figure 6.5.6: Consideration of e-learning as a coexisting approach for enhanced handing over

A further 109 participants (32.2%) indicated that they were unsure, and only 25 (7.4%) of the respondents consider e-learning as a coexisting approach for enhanced handing over should e learning be introduced.

6.6. Section D: Theoretical foundation of learning

This section of the survey sought to evaluate the theoretical foundation of learning in order to confirm its strategic importance in developing the knowledge sharing instruments required for an effective and efficient e-learning process (Jonassen & Land, 2000).

6.6.1. It is appropriate to include pedagogy (states how the content of a course is designed; recognises the learner's needs; and how the learning outcomes should be realised) in a theoretical foundation of learning for TVET to be effective

Occupation	Strongly agree	%	Agree	%	Not sure	%	Disagree	%	Strongly disagree	%
Principal	5	1.5	3	0.9	0	0	0	0	0	0
Campus Manager	10	2.9	2	0.6	0	0	0	0	0	0
Lecturer / Subject Specialist	84	24.8	7	2.1	0	0	0	0	0	0
Administrator	26	7.7	8	2.4	4	1.2	0	0	0	0
IT Expert	29	8.6	6	1.8	3	0.9	0	0	0	0
Student	128	37.8	19	5.6	5	1.5	0	0	0	0
Total	282	83.2	45	13.3	12	3.5	0	0	0	0

Table 6.6.1: Importance of including pedagogy in a theoretical foundation of learning

The participants were requested to indicate if it is appropriate to include pedagogy in a theoretical foundation of learning for TVET to be effective by selecting the relevant option provided (Strongly agree, Agree, Not sure, Disagree or Strongly disagree). As can be seen from Table 6.6.1 and Figure 6.6.1, the majority of participants (327, 96.5%) agreed with (Khan, 2005) that it is appropriate to include pedagogy in a theoretical foundation of learning for TVET to be effective and only 12 (3.5%) participants were not sure whether to include pedagogy or not.

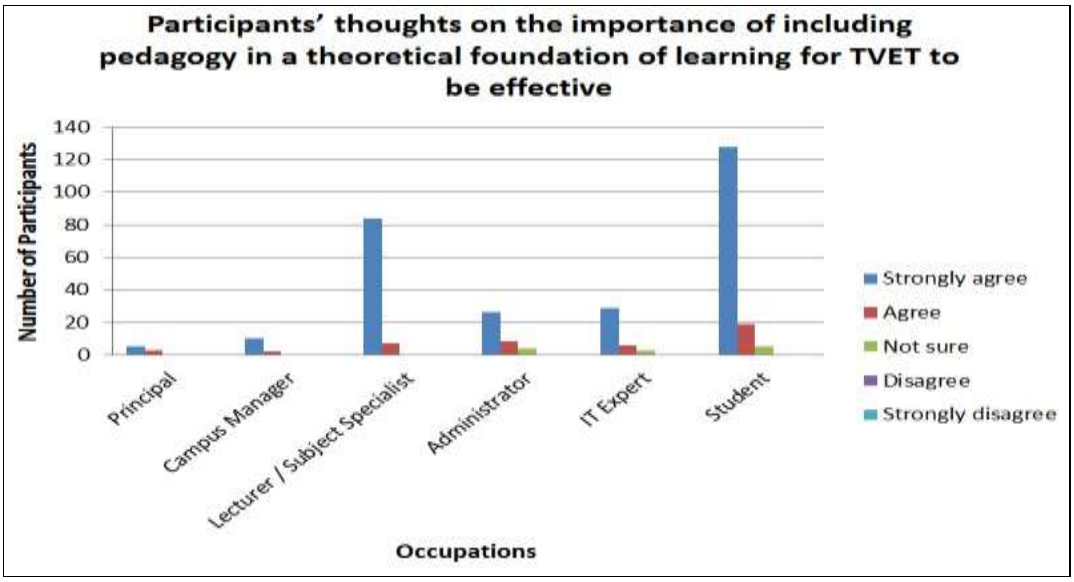

Figure 6.6.1: Importance of including pedagogy in a theoretical foundation of learning

6.6.2. The ethics play a crucial role in ensuring that matters concerning social and political influence, diversity, unfairness, information availability, good manners, and legal issues be handled with care within TVET

Occupation	Strongly agree	%	Agree	%	Not sure	%	Disagree	%	Strongly disagree	%
Principal	8	2.4	0	0	0	0	0	0	0	0
Campus Manager	11	3.2	1	0.3	0	0	0	0	0	0
Lecturer / Subject Specialist	87	25.7	4	1.2	0	0	0	0	0	0
Administrator	34	10.0	4	1.2	0	0	0	0	0	0
IT Expert	28	8.3	10	2.9	0	0	0	0	0	0
Student	93	27.4	59	17.4	0	0	0	0	0	0
Total	261	77.0	78	23.0	0	0	0	0	0	0

Table 6.6.2: Ethics play a crucial role within TVETs

The participants were requested to indicate if ethics play a crucial role in ensuring that matters concerning social and political influence, diversity, unfairness, information availability, good manners, and legal issues be handled with care within TVETs by selecting the relevant option provided (Strongly agree, Agree, Not sure, Disagree or Strongly disagree).

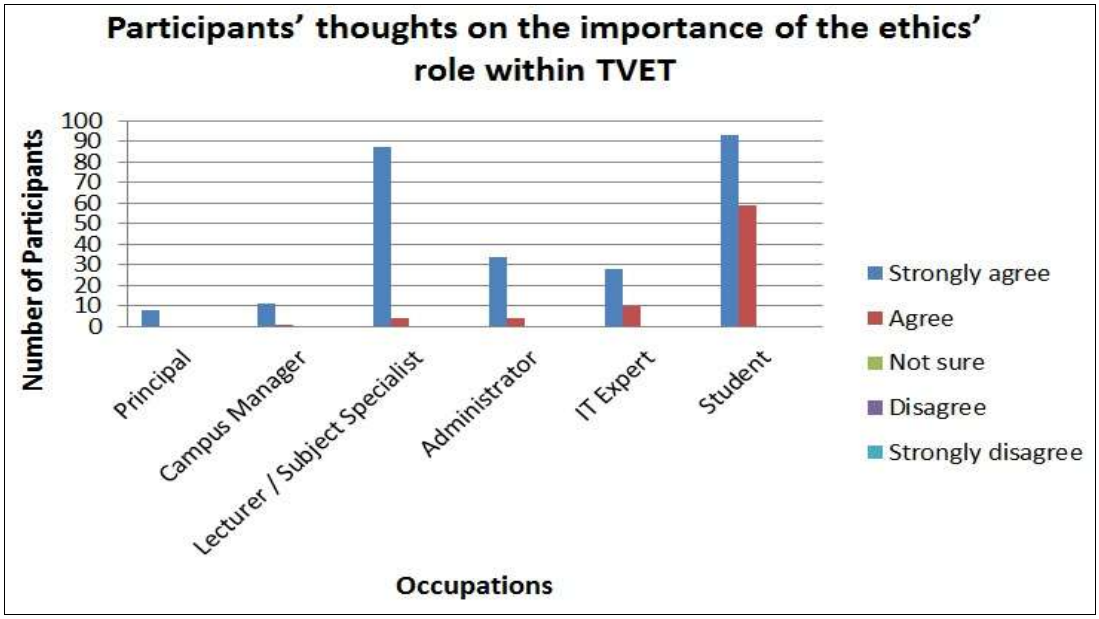

Figure 6.6.2: Ethics play a crucial role within TVETs

As can be seen from Table 6.6.2 and Figure 6.6.6, all (100%) participants shared the view of (Khan, 2005) that ethics play a crucial role in ensuring that matters concerning social and political influence, diversity, unfairness, information availability, good manners, and legal issues be handled with care within TVETs.

6.6.3. It is important to consider looking at institutional issues which comprised of administrative matters, academic affairs and student services within TVET when introducing e-learning

Occupation	Strongly agree	%	Agree	%	Not sure	%	Disagree	%	Strongly disagree	%
Principal	6	1.8	2	0.6	0	0	0	0	0	0
Campus Manager	6	1.8	6	1.8	0	0	0	0	0	0
Lecturer / Subject Specialist	85	25.1	6	1.8	0	0	0	0	0	0
Administrator	36	10.6	2	0.6	0	0	0	0	0	0
IT Expert	31	9.1	7	2.1	0	0	0	0	0	0
Student	97	28.6	55	16.2	0	0	0	0	0	0
Total	261	77.0	78	23.0	0	0	0	0	0	0

Table 6.6.3: Institutional issues within TVET are important when introducing e-learning

The participants were requested to indicate the importance of considering institutional issues such as administrative matters, academic affairs and student

services within TVETs when introducing e-learning by selecting the relevant option provided (Strongly agree, Agree, Not sure, Disagree or Strongly disagree).

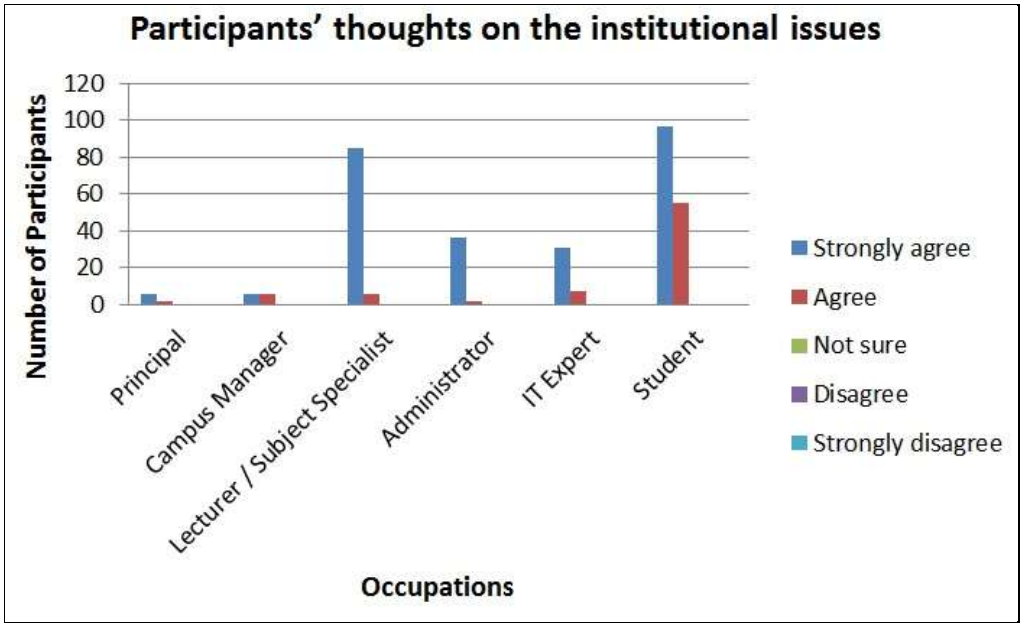

Figure 6.6.3: Institutional issues within TVET are important when introducing e-learning

As can be seen from Table 6.6.3 and Figure 6.6.3, all participants (100%) shared the view of (Khan, 2005) that it is important to consider institutional issues within TVETs when introducing e-learning.

6.6.4. The resource support should be part of the TVET theoretical foundation of learning as it considers all the support required for human and technical resources in order to build significant and fruitful online learning environments

Occupation	Strongly agree	%	Agree	%	Not sure	%	Disagree	%	Strongly disagree	%
Principal	7	2.1	1	0.3	0	0	0	0	0	0
Campus Manager	10	2.9	2	0.6	0	0	0	0	0	0
Lecturer / Subject Specialist	29	8.6	62	18.3	0	0	0	0	0	0
Administrator	8	2.4	30	8.8	0	0	0	0	0	0
IT Expert	16	4.7	22	6.5	0	0	0	0	0	0
Student	74	21.8	78	23.0	0	0	0	0	0	0
Total	144	42.5	195	57.5	0	0	0	0	0	0

Table 6.6.4: Resource support should be part of the TVET theoretical foundation of learning

The participants were requested to indicate if the resource support should be part of the TVET theoretical foundation of learning considers the degree of support required for human and technical resources in order to build significant and fruitful online learning environments by selecting the relevant option provided (Strongly agree, Agree, Not sure, Disagree or Strongly disagree).

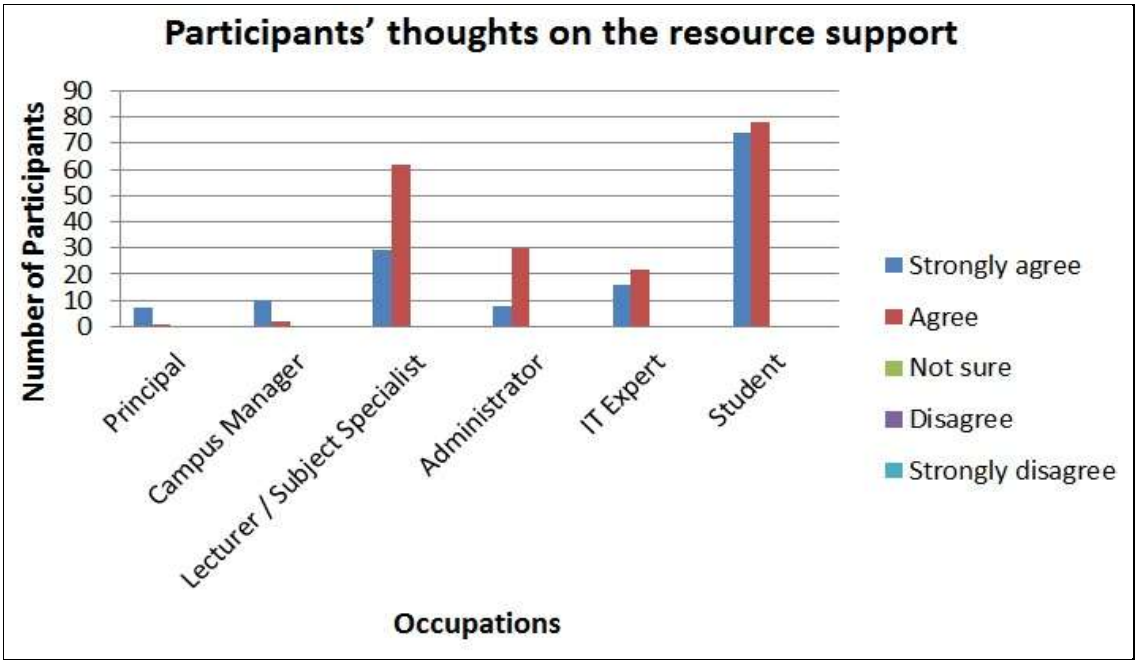

Figure 6.6.4: Resource support should be part of the TVET theoretical foundation of learning

As can be seen from Table 6.6.4 and Figure 6.6.4, all participants (100%) shared the view of (Khan, 2005) that resource support should be part of the TVET theoretical foundation of learning as it considers all the support required for human and technical resources in order to build significant and fruitful online learning environments.

6.6.5. Industry engagement should be part of the TVET theoretical foundation of learning as it ensures that TVET produces students that are adequately trained for an industry or workplace

Occupation	Strongly agree	%	Agree	%	Not sure	%	Disagree	%	Strongly disagree	%
Principal	4	1.2	4	1.2	0	0	0	0	0	0
Campus Manager	7	2.1	5	1.5	0	0	0	0	0	0
Lecturer / Subject Specialist	20	5.9	71	20.9	0	0	0	0	0	0
Administrator	17	5.0	21	6.2	0	0	0	0	0	0
IT Expert	5	1.5	33	9.7	0	0	0	0	0	0
Student	39	11.5	113	33.3	0	0	0	0	0	0
Total	92	27.1	247	72.9	0	0	0	0	0	0

Table 6.6.5: Industry engagement should be part of the TVET theoretical foundation of learning

The participants were requested to indicate if the industry engagement should be part of the TVET theoretical foundation of learning as it ensures that TVET produces students that are adequately trained for an industry or workplace, by selecting the relevant option provided (Strongly agree, Agree, Not sure, Disagree or Strongly disagree).

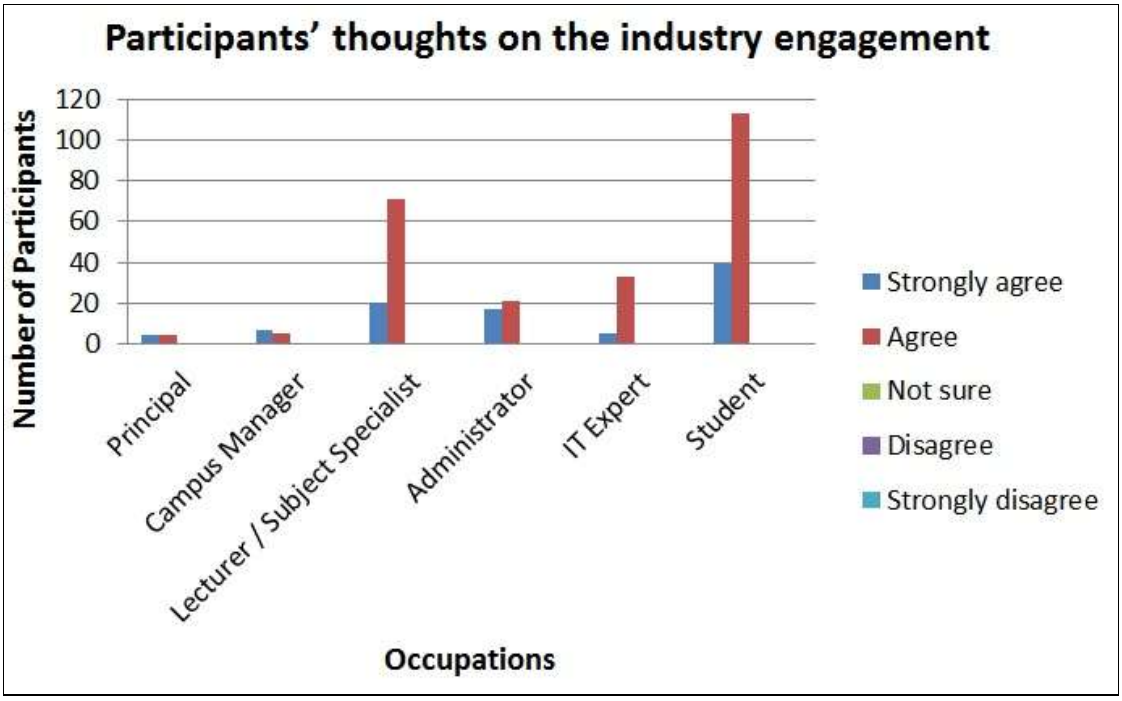

Figure 6.6.5: Industry engagement should be part of the TVET theoretical foundation of learning

As can be seen from Table 6.6.5 and Figure 6.6.5, all participants (100%) shared the view of (Khan, 2005) that industry engagement should be part of the TVET theoretical foundation of learning as it ensures that TVET produces students that are adequately trained for an industry or workplace.

6.6.6. The interface design should be included in the TVET theoretical foundation of learning as it ensures that system design, content design, navigation, course availability and usability testing; improves learning

Occupation	Strongly agree	%	Agree	%	Not sure	%	Disagree	%	Strongly disagree	%
Principal	4	1.2	4	1.2	0	0	0	0	0	0
Campus Manager	1	0.3	11	3.2	0	0	0	0	0	0
Lecturer / Subject Specialist	12	3.5	79	23.3	0	0	0	0	0	0
Administrator	13	3.8	25	7.4	0	0	0	0	0	0
IT Expert	4	1.2	34	10.0	0	0	0	0	0	0
Student	16	4.7	136	40.1	0	0	0	0	0	0
Total	50	14.7	289	85.3	0	0	0	0	0	0

Table 6.6.6: Interface design should be included in the TVET theoretical foundation of learning

The participants were requested to indicate if the interface design should be part of the TVET theoretical foundation of learning as it ensures that system design, content design, navigation, course availability and usability testing; improves learning, by selecting the relevant option provided (Strongly agree, Agree, Not sure, Disagree or Strongly disagree). As can be seen from Table 6.6.6 and Figure 6.6.6, all participants (100%) shared the view of (Khan, 2005) that interface design should be included in the TVET theoretical foundation of learning as it ensures that system design, navigation, content design, usability testing and course availability; improves learning.

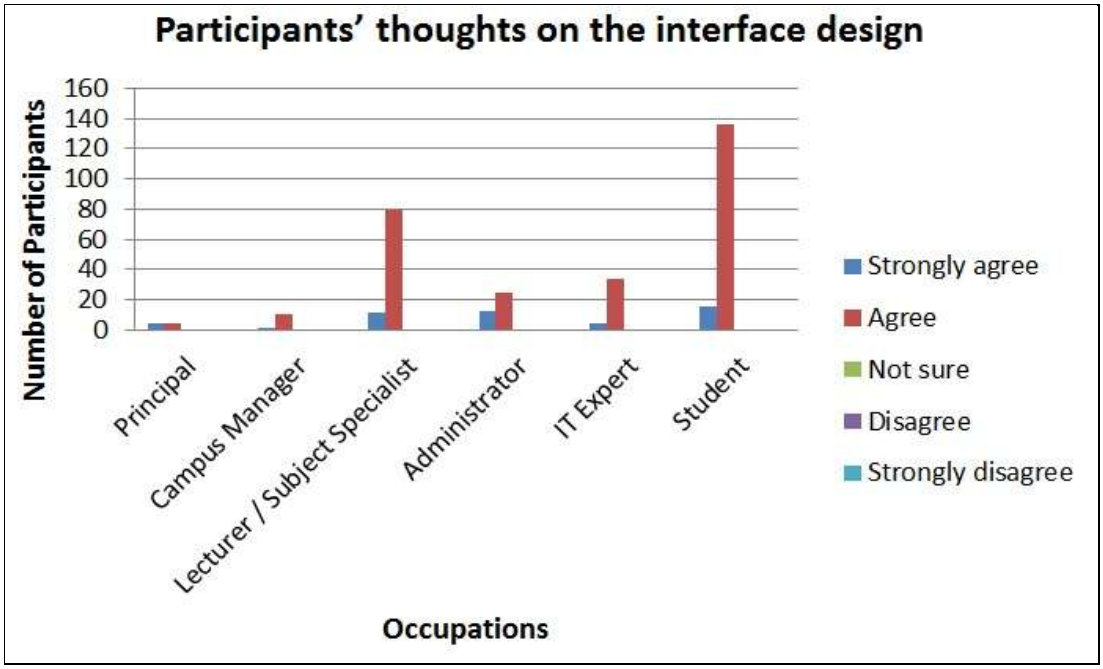

Figure 6.6.6: Interface design should be included in the TVET theoretical foundation of learning

6.6.7. Technology is an enabler of learning and should be included in the TVET theoretical foundation of learning as it enhances access to learning

Occupation	Strongly agree	%	Agree	%	Not sure	%	Disagree	%	Strongly disagree	%
Principal	1	0.3	7	2.1	0	0	0	0	0	0
Campus Manager	0	0.0	12	3.5	0	0	0	0	0	0
Lecturer / Subject Specialist	5	1.5	86	25.4	0	0	0	0	0	0
Administrator	9	2.7	29	8.6	0	0	0	0	0	0
IT Expert	6	1.8	32	9.4	0	0	0	0	0	0
Student	21	6.2	131	38.6	0	0	0	0	0	0
Total	42	12.4	297	87.6	0	0	0	0	0	0

Table 6.6.7: Technology is an enabler of learning and should be included in the TVET theoretical foundation of learning

The participants were requested to indicate if technology as an enabler of learning should be included in the TVET theoretical foundation of learning as it enhances access to learning, by selecting the relevant option provided (Strongly agree, Agree, Not sure, Disagree or Strongly disagree).

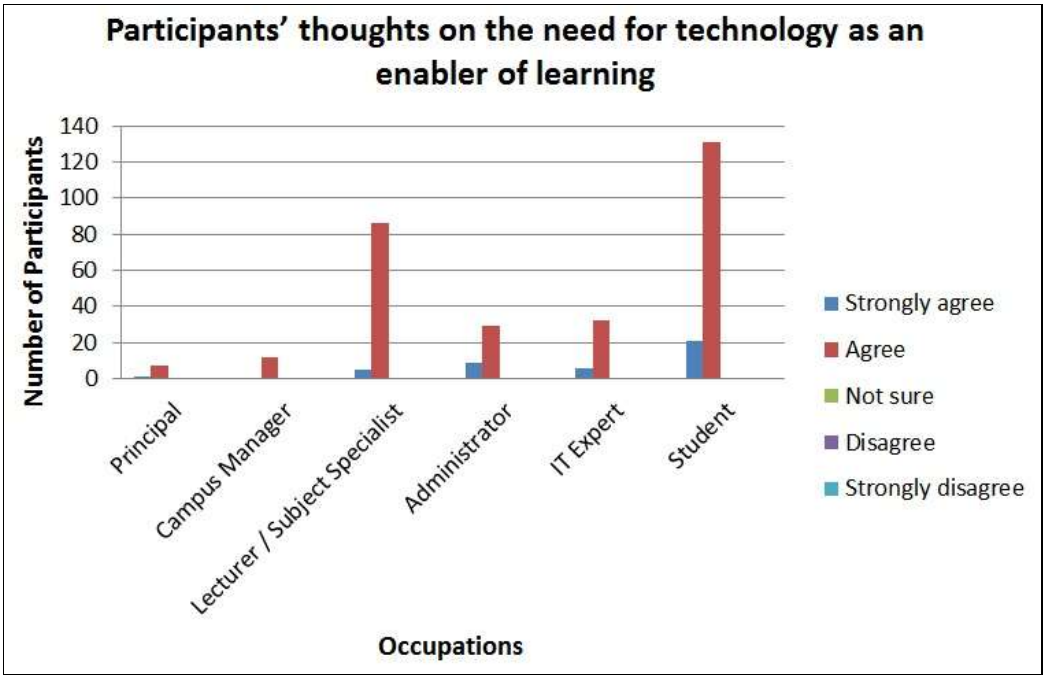

Figure 6.6.7: Technology is an enabler of learning and should be included in the TVET theoretical foundation of learning

As can be seen from Table 6.6.7 and Figure 6.6.7, all participants (100%) shared the view of (Khan, 2005) that technology is an enabler of learning and should be included in the TVET theoretical foundation of learning as it enhances access to learning.

6.6.8. It is appropriate for pedagogy, ethics and institutional to be grouped together under regulations

Occupation	Strongly agree	%	Agree	%	Not sure	%	Disagree	%	Strongly disagree	%
Principal	4	1.2	4	1.2	0	0	0	0	0	0
Campus Manager	4	1.2	8	2.4	0	0	0	0	0	0
Lecturer / Subject Specialist	11	3.2	80	23.6	0	0	0	0	0	0
Administrator	14	4.1	24	7.1	0	0	0	0	0	0
IT Expert	3	0.9	35	10.3	0	0	0	0	0	0
Student	19	5.6	133	39.2	0	0	0	0	0	0
Total	55	16.2	284	83.8	0	0	0	0	0	0

Table 6.6.8: The appropriateness of grouping pedagogy, ethics and institutional under regulations

Participants were requested to indicate if it is appropriate for pedagogy, ethics and institutional issues to be grouped together under regulations by selecting the relevant option provided (Strongly agree, Agree, Not sure, Disagree or Strongly disagree).

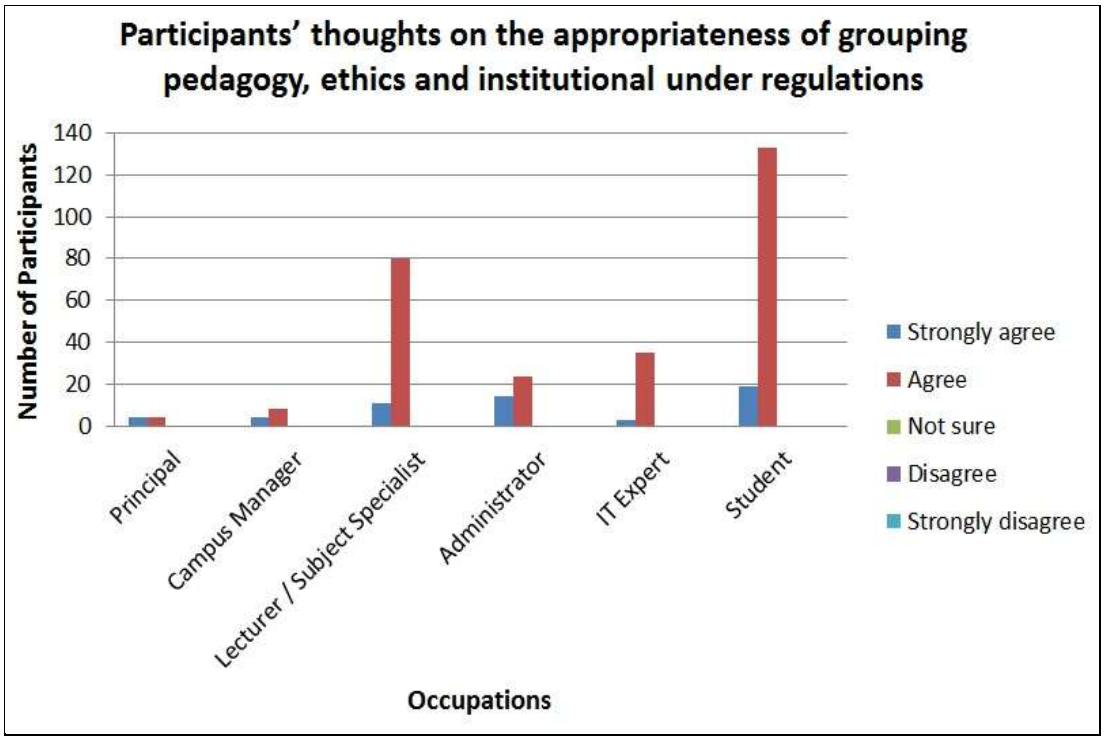

Figure 6.6.8: The appropriateness of grouping pedagogy, ethics and institutional under regulations

As can be seen from Table 6.6.8 and Figure 6.6.8, all participants (100%) shared the view of (Khan, 2005) that it is appropriate for pedagogy, ethics and institutional to be grouped together under regulations.

6.6.9. It is appropriate for resource support, industry engagement and interface design to be grouped together under managed services

Occupation	Strongly agree	%	Agree	%	Not sure	%	Disagree	%	Strongly disagree	%
Principal	1	0.3	7	2.1	0	0	0	0	0	0
Campus Manager	0	0.0	12	3.5	0	0	0	0	0	0
Lecturer / Subject Specialist	9	2.7	82	24.2	0	0	0	0	0	0
Administrator	12	3.5	26	7.7	0	0	0	0	0	0
IT Expert	1	0.3	37	10.9	0	0	0	0	0	0
Student	20	5.9	132	38.9	0	0	0	0	0	0
Total	43	12.7	296	87.3	0	0	0	0	0	0

Table 6.6.9: The appropriateness of grouping resource support, industry engagement and interface design under managed services

The participants were requested to indicate if it is appropriate for resource support, industry engagement and interface design to be grouped together under managed services by selecting the relevant option provided (Strongly agree, Agree, Not sure, Disagree or Strongly disagree).

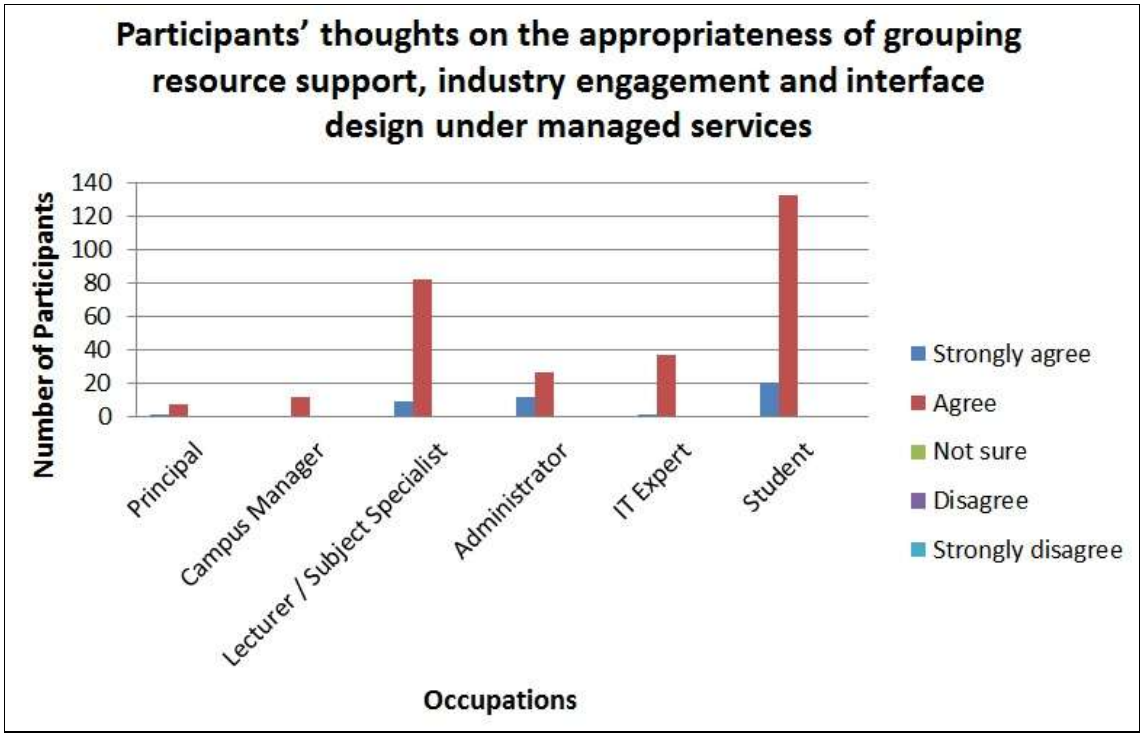

Figure 6.6.9: The appropriateness of grouping resource support, industry engagement and interface design under managed services

As can be seen from Table 6.6.9 and Figure 6.6.9, all participants (100%) shared the view of (Khan, 2005) that it is appropriate for resource support, industry engagement and interface design to be grouped together under managed services.

6.6.10. Technology should be on its own as an enabler of learning

Occupation	Strongly agree	%	Agree	%	Not sure	%	Disagree	%	Strongly disagree	%
Principal	0	0	8	2.4	0	0	0	0	0	0
Campus Manager	0	0	12	3.5	0	0	0	0	0	0
Lecturer / Subject Specialist	19	5.6	72	21.2	0	0	0	0	0	0
Administrator	11	3.2	27	8.0	0	0	0	0	0	0
IT Expert	33	9.7	5	1.5	0	0	0	0	0	0
Student	10	2.9	142	41.9	0	0	0	0	0	0
Total	73	21.5	266	78.5	0	0	0	0	0	0

Table 6.6.10: Technology on its own should be able to enable learning

The participants were requested to indicate if technology should be on its own as an enabler of learning by selecting the relevant option provided (Strongly agree, Agree, Not sure, Disagree or Strongly disagree) and all 339 participants responded to this question.

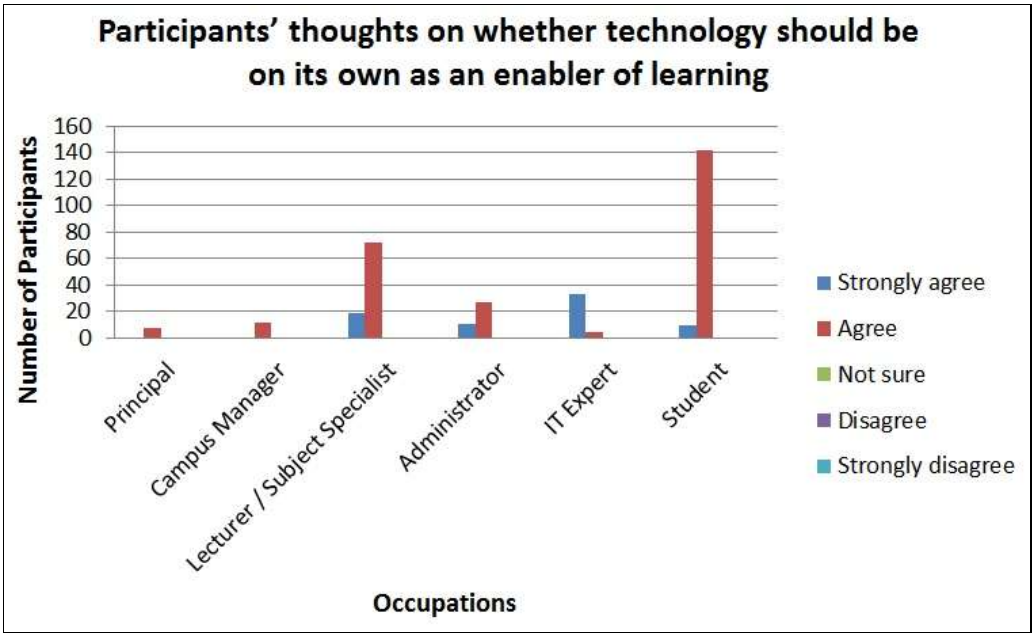

Figure 6.6.10: Technology on its own should be able to enable learning

As can be seen from Table 6.6.8 and Figure 6.6.8, all participants (100%) shared the view of (Khan, Managing e-learning: Design, delivery, implementation, and evaluation, 2005) that it is appropriate for technology to stand on its own as an enabler of learning.

6.6.11. The observation and assessment of the theoretical foundation of learning should be conducted continuously to ensure the best foundation

Occupation	Strongly agree	%	Agree	%	Not sure	%	Disagree	%	Strongly disagree	%
Principal	8	2.4	0	0	0	0	0	0	0	0
Campus Manager	12	3.5	0	0	0	0	0	0	0	0
Lecturer / Subject Specialist	91	26.8	0	0	0	0	0	0	0	0
Administrator	38	11.2	0	0	0	0	0	0	0	0
IT Expert	38	11.2	0	0	0	0	0	0	0	0
Student	152	44.8	0	0	0	0	0	0	0	0
Total	339	100.0	0	0	0	0	0	0	0	0

Table 6.6.11: Observation and assessment of the theoretical foundation of learning should be conducted continuously

The participants were requested to indicate if observation and assessment of the theoretical foundation of learning should be conducted continuously to ensure the best foundation, by selecting the relevant option provided (Strongly agree, Agree, Not sure, Disagree or Strongly disagree).

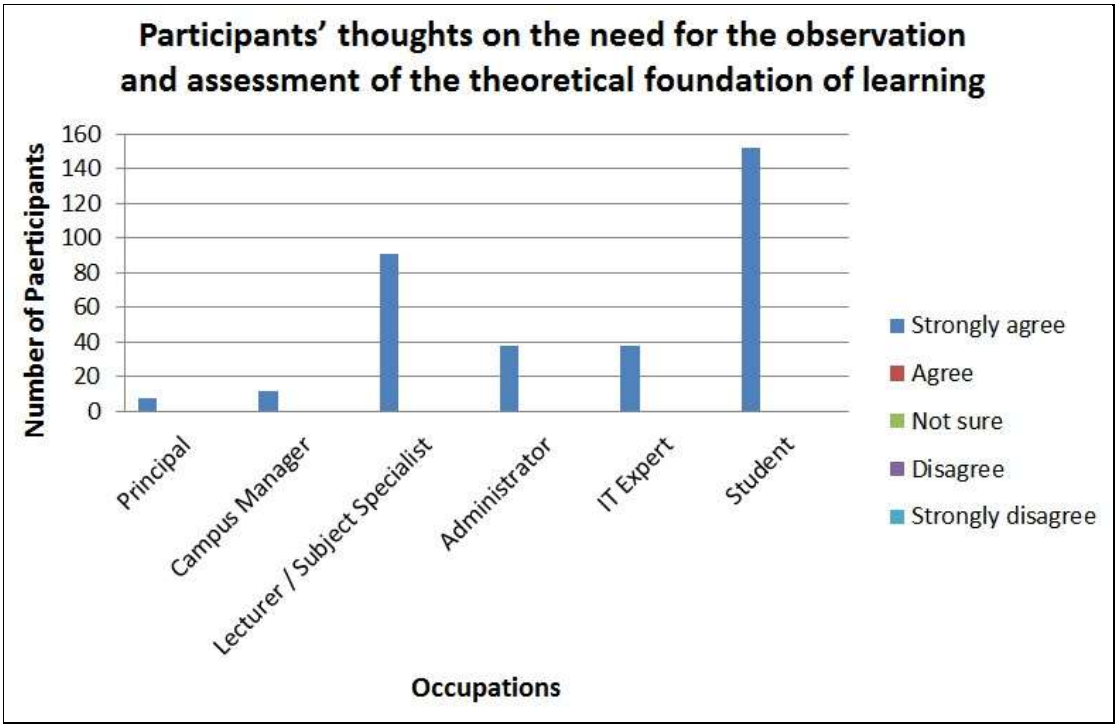

Figure 6.6.11: Observation and assessment of the theoretical foundation of learning should be conducted continuously

As can be seen from Table 6.6.11 and Figure 6.6.11, all participants (100%) shared the view of (Khan, 2005) that the monitoring and evaluation of the theoretical foundation of learning should be conducted continuously to ensure the best foundation.

6.7. Section E: Conceptual technical building blocks

The intention of this section was to assess the conceptual technical building blocks in order to check the importance of KS principles to ensure that they were incorporated into an e-learning framework for the system to meet the stakeholders' needs, especially the learners.

6.7.1. The desktop/PC should be one of the devices to ensure access is granted to users in a specific location

Occupation	Strongly agree	%	Agree	%	Not sure	%	Disagree	%	Strongly disagree	%
Principal	8	2.4	0	0	0	0	0	0	0	0
Campus Manager	11	3.2	1	0.3	0	0	0	0	0	0
Lecturer / Subject Specialist	91	26.8	0	0	0	0	0	0	0	0
Administrator	38	11.2	0	0	0	0	0	0	0	0
IT Expert	38	11.2	0	0	0	0	0	0	0	0
Student	151	44.5	1	0.3	0	0	0	0	0	0
Total	337	99.4	2	0.6	0	0	0	0	0	0

Table 6.7.1: The desktop/PC should be one of the devices available

The participants were requested to indicate if the desktop/PC should be one of the devices to ensure access is granted to users in a specific location by selecting the relevant option provided (Strongly agree, Agree, Not sure, Disagree or Strongly disagree).

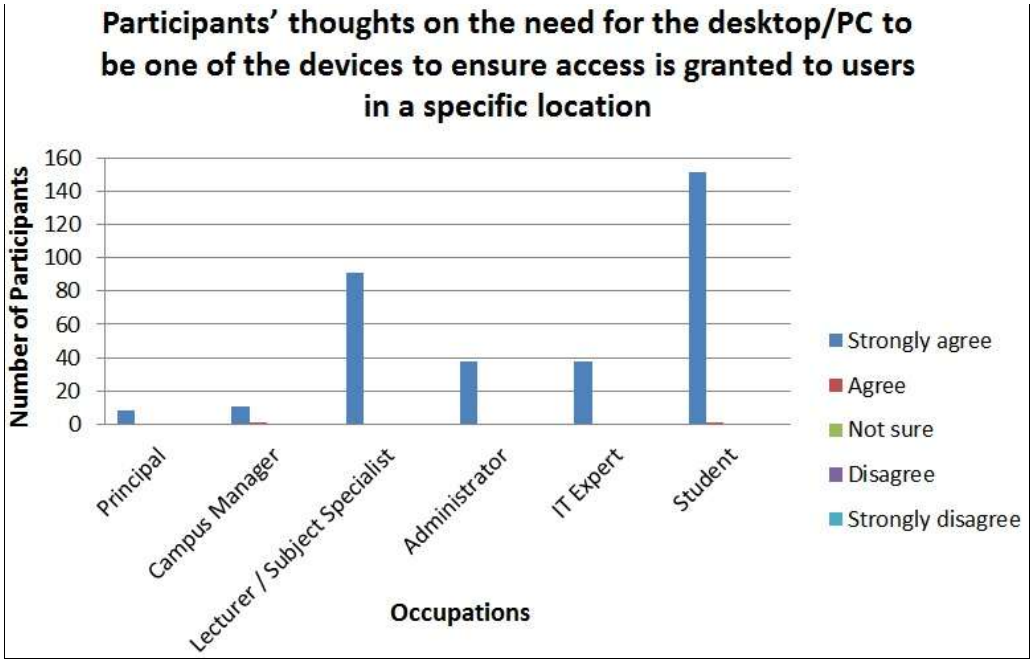

Figure 6.7.1: The desktop/PC should be one of the devices available

As can be seen from Table 6.6.8 and Figure 6.6.8, all participants (100%) shared the view of (TopUniversities, 2013) that the desktop/PC should be one of the devices available to ensure access is granted to users in a specific location.

6.7.2. The laptop should be one of the devices available to ensure access is granted to users wherever they go

Occupation	Strongly agree	%	Agree	%	Not sure	%	Disagree	%	Strongly disagree	%
Principal	8	2.4	0	0	0	0	0	0	0	0
Campus Manager	11	3.2	1	0.3	0	0	0	0	0	0
Lecturer / Subject Specialist	89	26.3	2	0.6	0	0	0	0	0	0
Administrator	38	11.2	0	0	0	0	0	0	0	0
IT Expert	38	11.2	0	0	0	0	0	0	0	0
Student	139	41.0	13	3.8	0	0	0	0	0	0
Total	323	95.3	16	4.7	0	0	0	0	0	0

Table 6.7.2: The laptop should be one of the devices available

The participants were requested to indicate if the laptop should be one of the devices available to ensure access is granted to users wherever they go, by selecting the relevant option provided (Strongly agree, Agree, Not sure, Disagree or Strongly disagree).

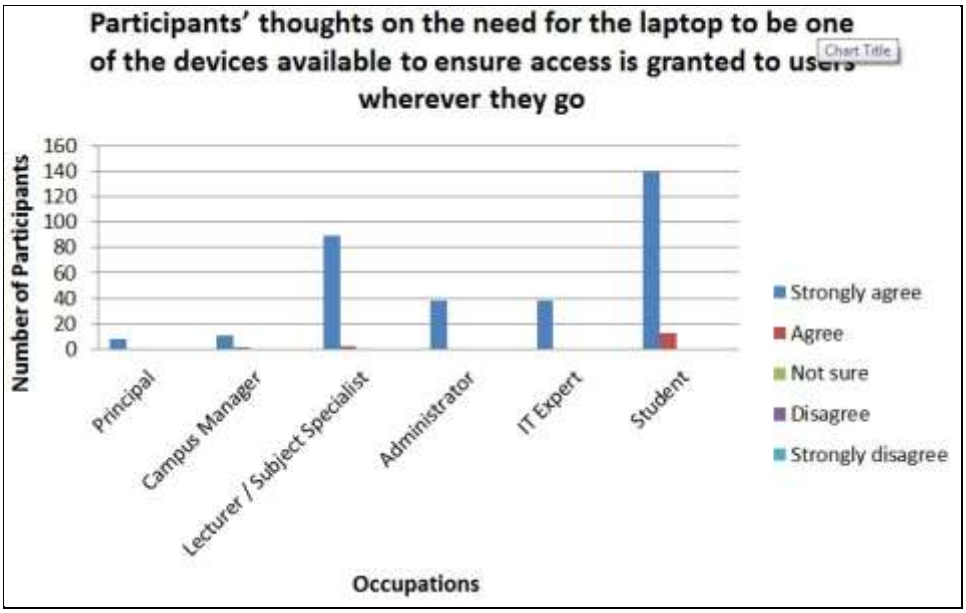

Figure 6.7.2: The laptop should be one of the devices available

As can be seen from Table 6.6.8 and Figure 6.6.8, all participants (100%) shared the view of (TopUniversities, 2013) that the laptop should be one of the devices available to ensure access is granted to users wherever they go.

6.7.3. The mobile device should be one of the devices available to ensure access is granted to online learning using any of the smartphone

Occupation	Strongly agree	%	Agree	%	Not sure	%	Disagree	%	Strongly disagree	%
Principal	8	2.4	0	0	0	0	0	0	0	0
Campus Manager	11	3.2	1	0.3	0	0	0	0	0	0
Lecturer / Subject Specialist	91	26.8	0	0	0	0	0	0	0	0
Administrator	38	11.2	0	0	0	0	0	0	0	0
IT Expert	38	11.2	0	0	0	0	0	0	0	0
Student	148	43.7	4	1.2	0	0	0	0	0	0
Total	334	98.5	5	1.5	0	0	0	0	0	0

Table 6.7.3: The mobile device should be one of the devices available

The participants were requested to indicate if the mobile device should be one of the devices available to ensure access is granted to online learning using any of the smartphone by selecting the relevant option provided (Strongly agree, Agree, Not sure, Disagree or Strongly disagree).

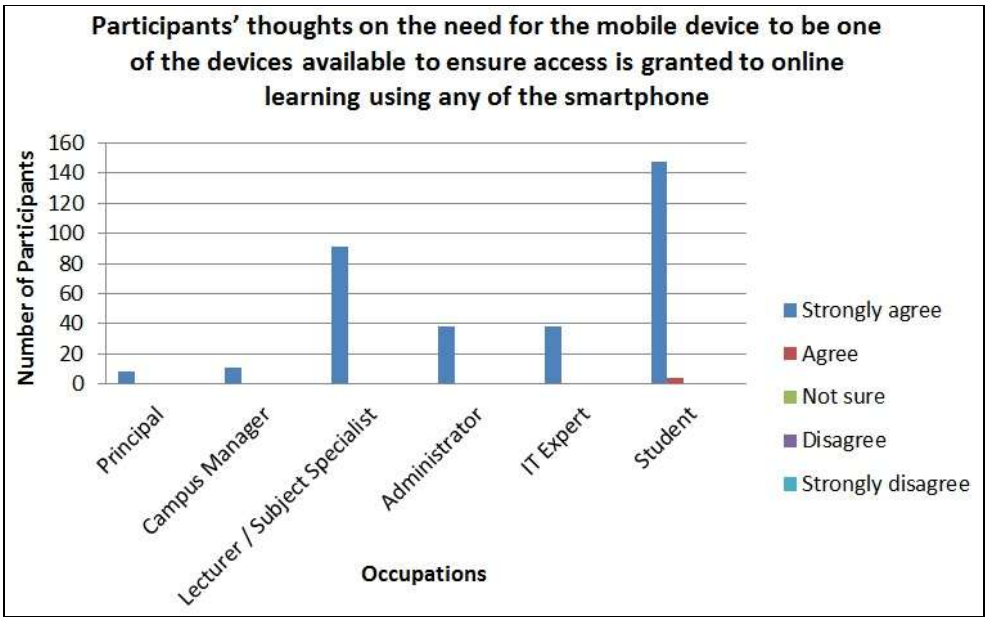

Figure 6.7.3: The mobile device should be one of the devices available

As can be seen from Table 6.7.3 and Figure 6.7.3, all participants (100%) shared the view of (TopUniversities, 2013) that the mobile device should be one of the devices available to ensure access is granted to online learning using any of the smartphone. The study by (TopUniversities, 2013) reports that the use of mobile devices was supported by respondents younger than 21 years old. In the current study all age groups supported the use of mobile devices.

6.7.4. It is good to have a student area as one of the available items to ensure students have a specialised access to online learning where access is limited to what they need

Occupation	Strongly agree	%	Agree	%	Not sure	%	Disagree	%	Strongly disagree	%
Principal	8	2.4	0	0	0	0	0	0	0	0
Campus Manager	10	2.9	2	0.6	0	0	0	0	0	0
Lecturer / Subject Specialist	89	26.3	2	0.6	0	0	0	0	0	0
Administrator	38	11.2	0	0	0	0	0	0	0	0
IT Expert	38	11.2	0	0	0	0	0	0	0	0
Student	139	41.0	13	3.8	0	0	0	0	0	0
Total	322	95.0	17	5.0	0	0	0	0	0	0

Table 6.7.4: The need to have a student area as one of the available areas

The participants were requested to indicate if it is good to have a student area as one of the available areas to ensure students have specialised access to online learning where access is limited to what they need, by selecting the relevant option provided (Strongly agree, Agree, Not sure, Disagree or Strongly disagree). As can be seen from Table 6.7.4 and Figure 6.7.4, all participants (100%) shared the view that it is good to have a student area as one of the available locations to ensure students have a specialised access to online learning where access is limited to what they need.

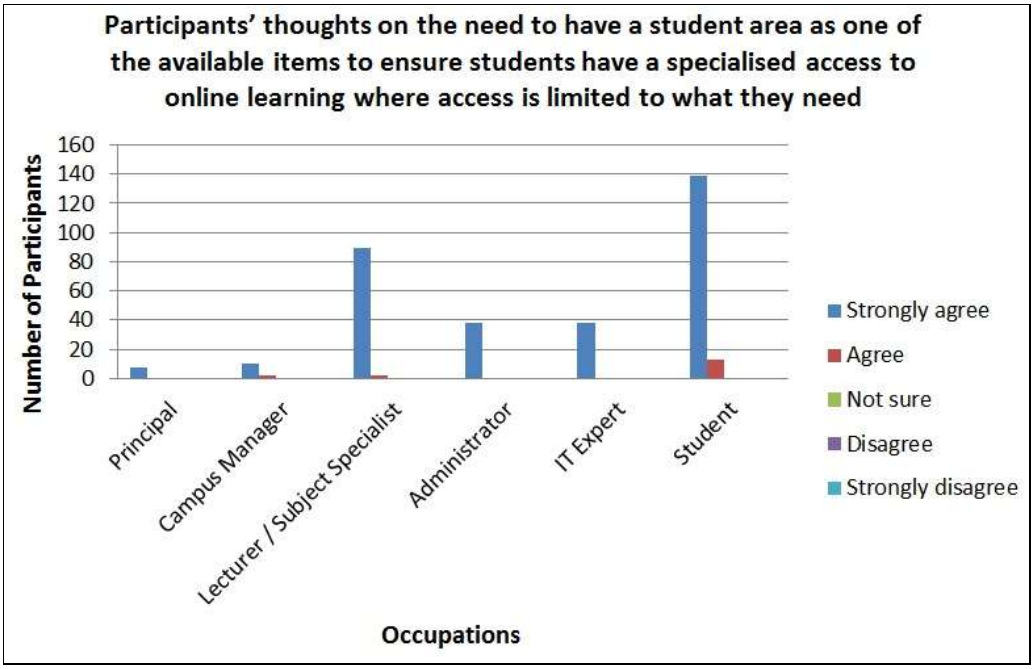

Figure 6.7.4: The need to have a student area as one of the available areas

6.7.5. It is good to have a lecturer's area as one of the available areas to ensure lecturers have a specialised access to online learning where access is limited to what they need

Occupation	Strongly agree	%	Agree	%	Not sure	%	Disagree	%	Strongly disagree	%
Principal	8	2.4	0	0	0	0	0	0	0	0
Campus Manager	11	3.2	1	0.3	0	0	0	0	0	0
Lecturer / Subject Specialist	84	24.8	7	2.1	0	0	0	0	0	0
Administrator	38	11.2	0	0	0	0	0	0	0	0
IT Expert	38	11.2	0	0	0	0	0	0	0	0
Student	136	40.1	16	4.7	0	0	0	0	0	0
Total	315	92.9	24	7.1	0	0	0	0	0	0

Table 6.7.5: The need to have a lecturer area as one of the available areas

The participants were requested to indicate if it is good to have a lecturer area as one of the available areas to ensure lecturers have a specialised access to online learning by selecting the relevant option provided (Strongly agree, Agree, Not sure, Disagree or Strongly disagree).

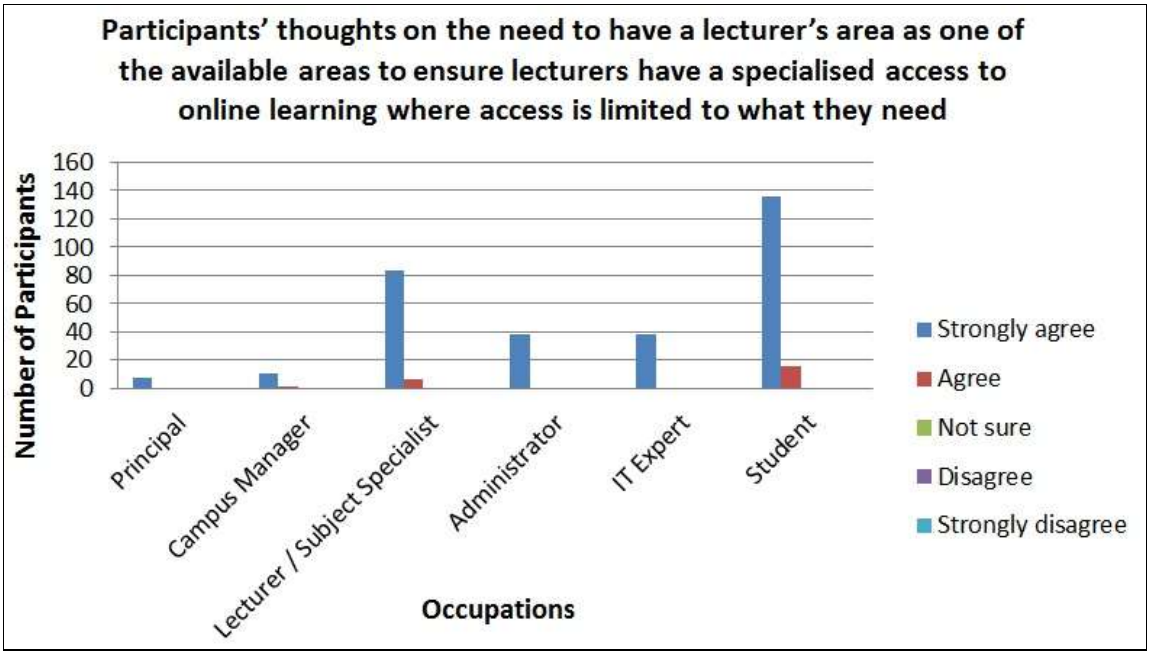

Figure 6.7.5: The need to have a lecturer area as one of the available areas

As can be seen from Table 6.7.5 and Figure 6.7.5, all participants (100%) were of the view that it is good to have a lecturer area as one of the available areas to ensure lecturers have specialised access to online learning where access is limited to what they need.

6.7.6. The admin area should be one of the areas available to ensure administrators have a specialised access to online learning where access is limited to what they need

Occupation	Strongly agree	%	Agree	%	Not sure	%	Disagree	%	Strongly disagree	%
Principal	8	2.4	0	0	0	0	0	0	0	0
Campus Manager	10	2.9	2	0.6	0	0	0	0	0	0
Lecturer / Subject Specialist	86	25.4	5	1.5	0	0	0	0	0	0
Administrator	29	8.6	9	2.7	0	0	0	0	0	0
IT Expert	27	8.0	11	3.2	0	0	0	0	0	0
Student	137	40.4	15	4.4	0	0	0	0	0	0
Total	297	87.6	42	12.4	0	0	0	0	0	0

Table 6.7.6: An admin area should be one of the areas available

The participants were requested to indicate if the admin area should be one of the areas available to ensure administrators have a specialised access to online learning

by selecting the relevant option provided (Strongly agree, Agree, Not sure, Disagree or Strongly disagree).

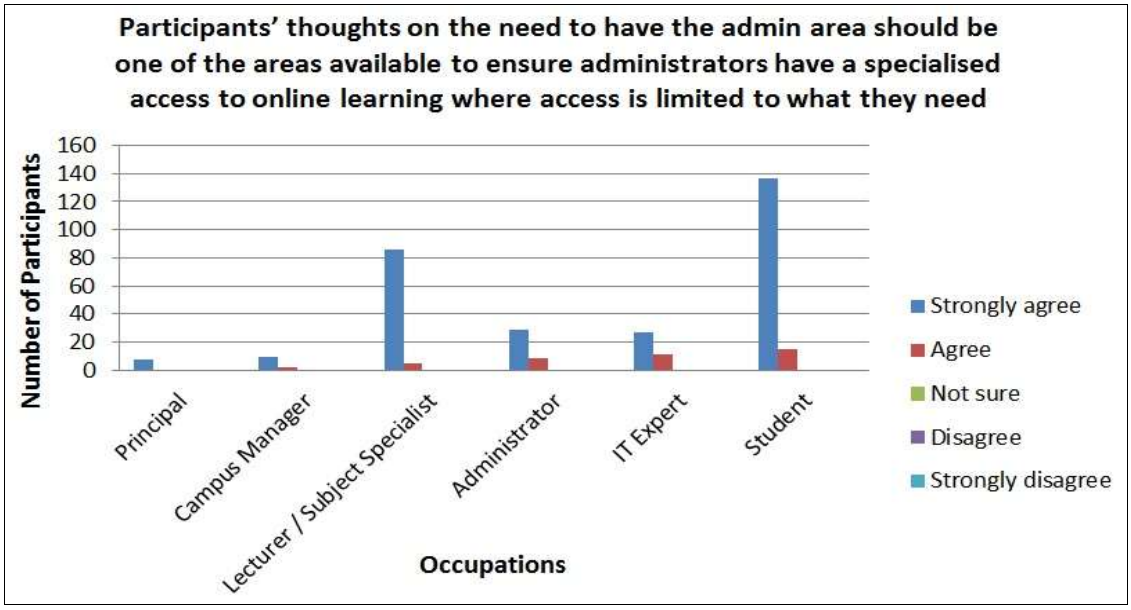

Figure 6.7.6: An admin area should be one of the areas available

As can be seen from Table 6.7.6 and Figure 6.7.6, all participants (100%) were of the view that an admin area should be one of the areas available to ensure administrators have specialised access to online learning where access is limited to what they need.

6.7.7. It is good to have a webmaster area as one of the areas available to ensure webmasters have specialised access to online learning where access is limited to what is expected from them

Occupation	Strongly agree	%	Agree	%	Not sure	%	Disagree	%	Strongly disagree	%
Principal	8	2.4	0	0	0	0	0	0	0	0
Campus Manager	10	2.9	2	0.6	0	0	0	0	0	0
Lecturer / Subject Specialist	87	25.7	4	1.2	0	0	0	0	0	0
Administrator	38	11.2	0	0	0	0	0	0	0	0
IT Expert	36	10.6	2	0.6	0	0	0	0	0	0
Student	138	40.7	9	2.7	5	0	0	0	0	0
Total	317	93.5	17	5.0	5	0	0	0	0	0

Table 6.7.7: A webmaster area should be one of the areas available

The participants were requested to indicate if it is good to have a webmaster area as one of the areas available to ensure webmasters have specialised access to online learning by selecting the relevant option provided (Strongly agree, Agree, Not sure, Disagree or Strongly disagree).

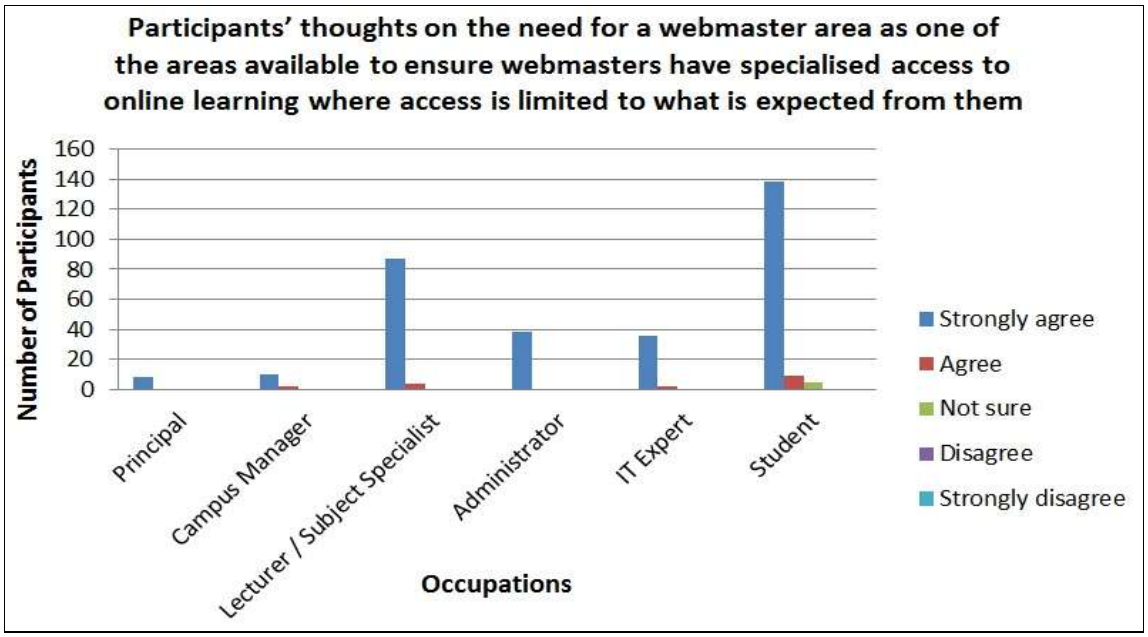

Figure 6.7.7: A webmaster area should be one of the areas available

As can be seen from Table 6.7.7 and Figure 6.7.7, the majority of participants (334, 98.5%) were of the view that it is good to have a webmaster area as one of the areas available to ensure webmasters have specialised access to online learning where access is limited to what is expected from them, and five (1.5%) were unsure.

6.7.8. The campus network should be one of the networks to ensure access is granted to online learning within a campus of an institution

Occupation	Strongly agree	%	Agree	%	Not sure	%	Disagree	%	Strongly disagree	%
Principal	8	2.4	0	0	0	0	0	0	0	0
Campus Manager	10	2.9	2	0.6	0	0	0	0	0	0
Lecturer / Subject Specialist	82	24.2	9	2.7	0	0	0	0	0	0
Administrator	38	11.2	0	0	0	0	0	0	0	0
IT Expert	38	11.2	0	0	0	0	0	0	0	0
Student	137	40.4	15	4.4	0	0	0	0	0	0
Total	313	92.3	26	7.7	0	0	0	0	0	0

Table 6.7.8: The campus network should be one of the networks available

The participants were requested to indicate if the campus network should be one of the networks available to ensure access is granted to online learning within a campus of an institution by selecting the relevant option provided (Strongly agree, Agree, Not sure, Disagree or Strongly disagree). As can be seen from Table 6.7.8 and Figure 6.7.8, all participants (100%) were of the view that the campus network should be one of the networks available to ensure access is granted to online learning within a campus of an institution.

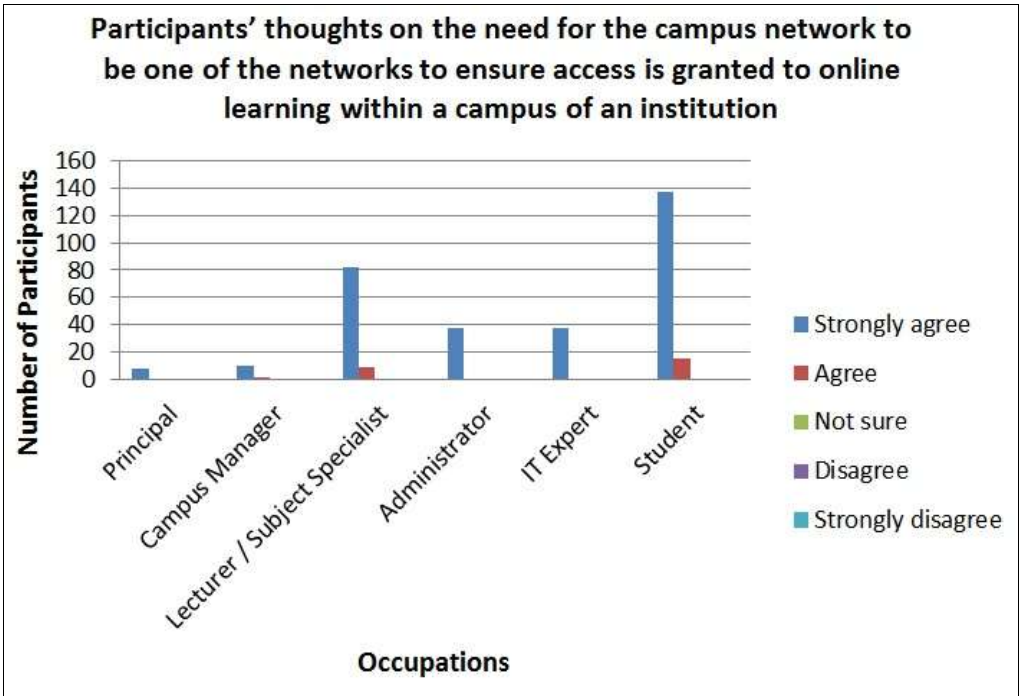

Figure 6.7.8: The campus network should be one of the networks available

6.7.9. The inter-campus network should be one of the networks to ensure access is granted to online learning across campuses of an institution

Occupation	Strongly agree	%	Agree	%	Not sure	%	Disagree	%	Strongly disagree	%
Principal	8	2.4	0	0	0	0	0	0	0	0
Campus Manager	10	2.9	2	0.6	0	0	0	0	0	0
Lecturer / Subject Specialist	89	26.3	2	0.6	0	0	0	0	0	0
Administrator	31	9.1	7	2.1	0	0	0	0	0	0
IT Expert	38	11.2	0	0	0	0	0	0	0	0
Student	139	41.0	13	3.8	0	0	0	0	0	0
Total	315	92.9	24	7.1	0	0	0	0	0	0

Table 6.7.9: The inter-campus network should be one of the networks available

The participants were requested to indicate if the inter-campus network should be one of the networks available to ensure access is granted to online learning across campuses of an institution by selecting the relevant option provided (Strongly agree, Agree, Not sure, Disagree or Strongly disagree).

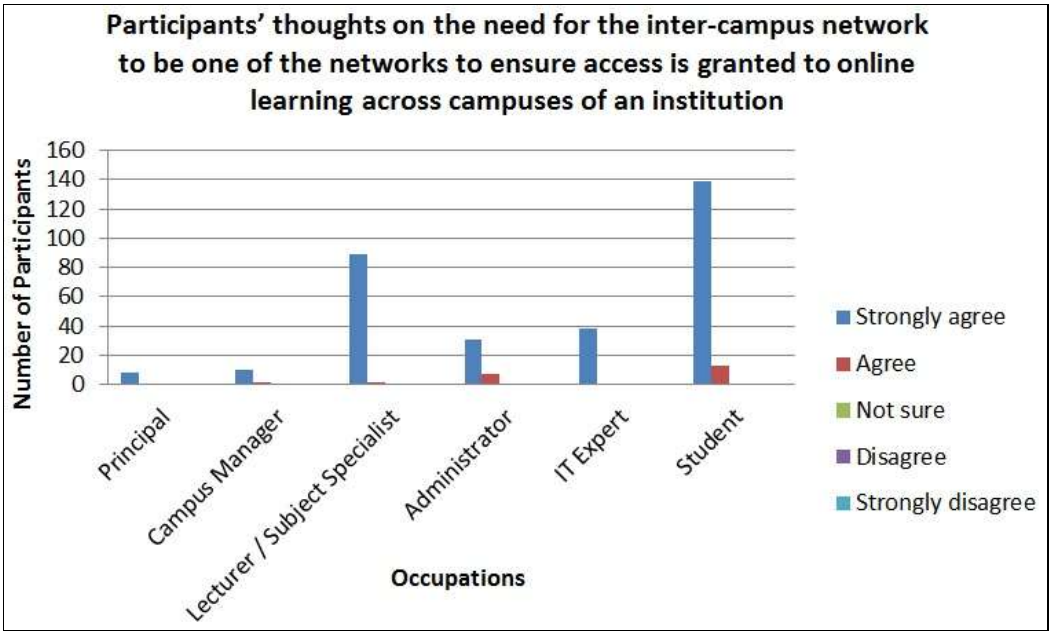

Figure 6.7.9: The need for the inter-campus network to be one of the networks available

As can be seen from Table 6.7.9 and Figure 6.7.9, all participants (100%) were of the view that the inter-campus network should be one of the networks available to ensure access is granted to online learning across campuses of an institution.

6.7.10. The public network should be one of the networks to ensure TVET stakeholders and the public are granted access to online learning away from an institution

Occupation	Strongly agree	%	Agree	%	Not sure	%	Disagree	%	Strongly disagree	%
Principal	8	2.4	0	0	0	0	0	0	0	0
Campus Manager	9	2.7	3	0.9	0	0	0	0	0	0
Lecturer / Subject Specialist	83	24.5	8	2.4	0	0	0	0	0	0
Administrator	32	9.4	6	1.8	0	0	0	0	0	0
IT Expert	38	11.2	0	0	0	0	0	0	0	0
Student	134	39.5	18	5.3	0	0	0	0	0	0
Total	304	89.7	35	10.3	0	0	0	0	0	0

Table 6.7.10: The public network to be one of the networks available

The participants were requested to indicate if the public network should be one of the networks available to ensure TVET stakeholders and the public are granted access to online learning away from an institution by selecting the relevant option provided (Strongly agree, Agree, Not sure, Disagree or Strongly disagree).

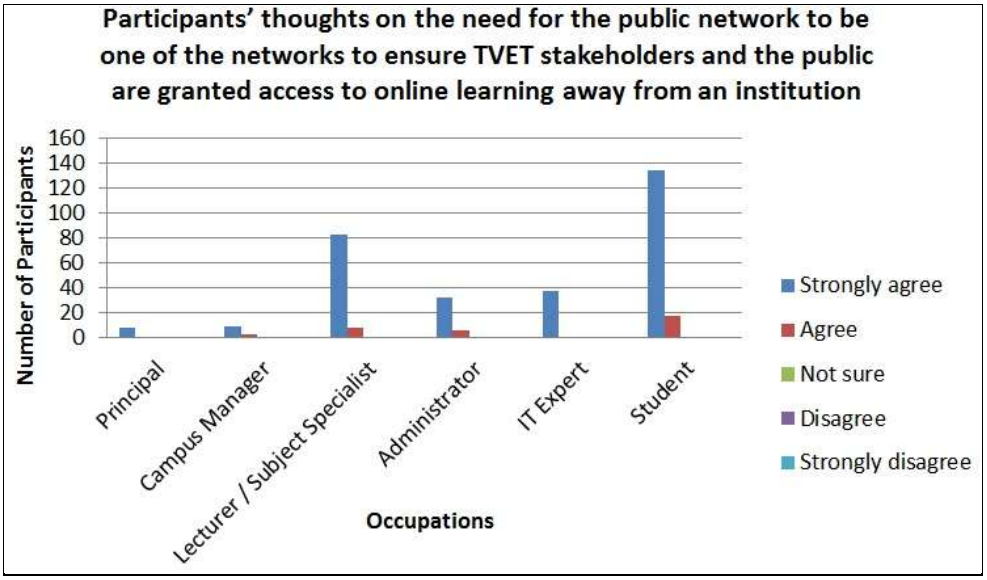

Figure 6.7.10: The public network to be one of the networks available

As can be seen from Table 6.7.10 and Figure 6.7.10, all participants (100%) were of the view that the public network should be one of the networks available to ensure

TVET stakeholders and the public are granted access to online learning away from an institution.

6.7.11. To ensure that only authorised personnel have access, it is quite important to control access to an online learning system under network channels

Occupation	Strongly agree	%	Agree	%	Not sure	%	Disagree	%	Strongly disagree	%
Principal	5	1.5	3	0.9	0	0	0	0	0	0
Campus Manager	8	2.4	4	1.2	0	0	0	0	0	0
Lecturer / Subject Specialist	86	25.4	5	1.5	0	0	0	0	0	0
Administrator	38	11.2	0	0	0	0	0	0	0	0
IT Expert	38	11.2	0	0	0	0	0	0	0	0
Student	139	41.0	9	2.7	4	1.2	0	0	0	0
Total	314	92.6	21	6.2	4	1.2	0	0	0	0

Table 6.7.11: The need to ensure that only authorised personnel have access

The participants were requested to indicate if it is quite important to control access to an online learning system under network channels to ensure that only authorised personnel have access by selecting the relevant option provided (Strongly agree, Agree, Not sure, Disagree or Strongly disagree).

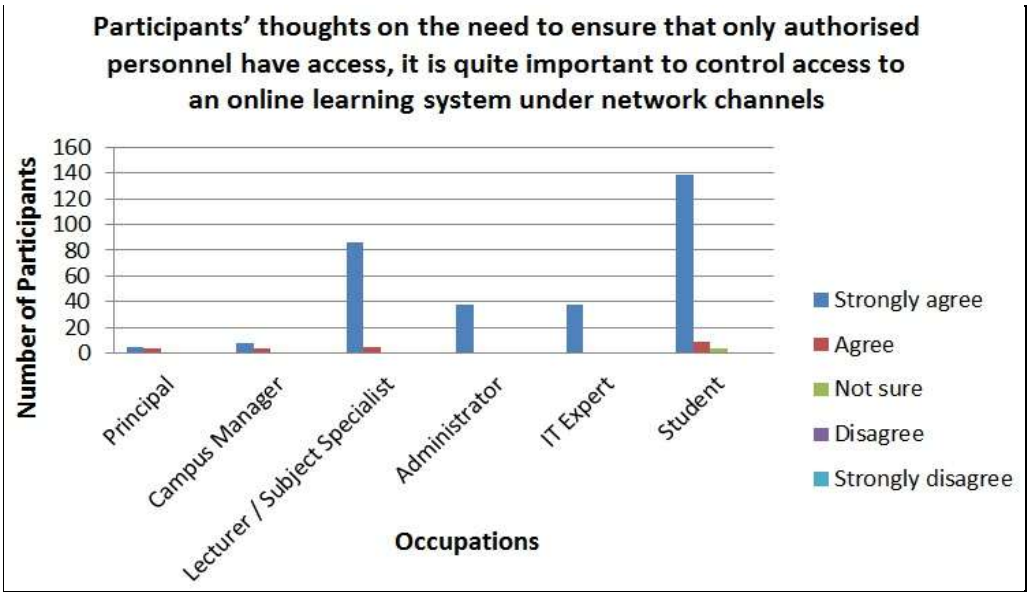

Figure 6.7.11: The need to ensure that only authorised personnel have access

As can be seen from Table 6.7.11 and Figure 6.7.11, the majority of participants (335, 98.8%) agreed that it is important to control access to an online learning system under network channels to ensure that only authorised personnel have access, and (4, 1.2%) were not sure.

6.7.12. It is good to have application & registration webserver together with the corresponding database as one of the backstage elements to allow online application & registration

Occupation	Strongly agree	%	Agree	%	Not sure	%	Disagree	%	Strongly disagree	%
Principal	0	0	5	1.5	0	0	3	0.9	0	0
Campus Manager	0	0	3	0.9	0	0	9	2.7	0	0
Lecturer / Subject Specialist	7	2.1	34	10.0	42	12.4	8	2.4	0	0
Administrator	6	1.8	10	2.9	8	2.4	14	4.1	0	0
IT Expert	11	3.2	19	5.6	5	1.5	3	0.9	0	0
Student	123	36.3	9	2.7	16	4.7	4	1.2	0	0
Total	147	43.4	80	23.6	71	20.9	41	12.1	0	0

Table 6.7.12: The need to have application and registration webserver together with the corresponding database

The participants were requested to indicate if it is good to have application and registration webserver together with the corresponding database as one of the backstage elements to allow online application and registration, by selecting the relevant option provided (Strongly agree, Agree, Not sure, Disagree or Strongly disagree).

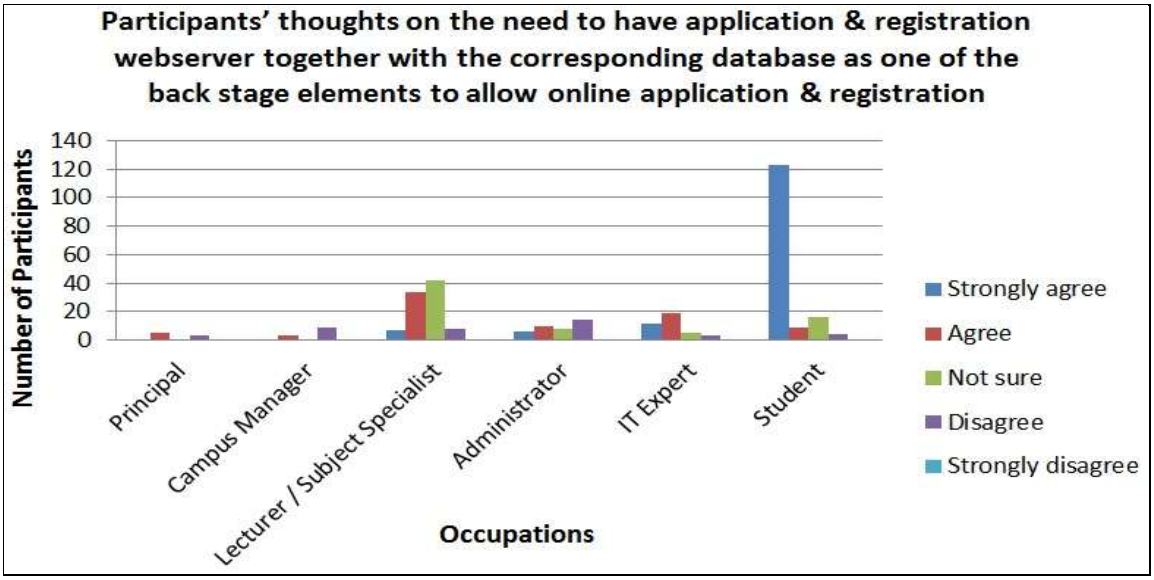

Figure 6.7.12: The need to have application and registration webserver together with the corresponding database

As can be seen from Table 6.7.12 and Figure 6.7.12, the majority of participants (227, 67.0%) were of the view that it is good to have the application and registration webserver together with the corresponding database as one of the backstage elements to allow online application and registration, 71 (20.9%) were unsure and 41 (12.1%) disagreed.

6.7.13. It is essential to have course content webserver together with the corresponding database as one of the backstage elements to allow online course content offering

Occupation	Strongly agree	%	Agree	%	Not sure	%	Disagree	%	Strongly disagree	%
Principal	8	2.4	0	0	0	0	0	0	0	0
Campus Manager	12	3.5	0	0	0	0	0	0	0	0
Lecturer / Subject Specialist	88	26.0	3	0.9	0	0	0	0	0	0
Administrator	32	9.4	6	1.8	0	0	0	0	0	0
IT Expert	38	11.2	0	0	0	0	0	0	0	0
Student	144	42.5	8	2.4	0	0	0	0	0	0
Total	322	95.0	17	5.0	0	0	0	0	0	0

Table 6.7.13: The need to have course content webserver together with the corresponding database

The participants were requested to indicate if it is essential to have course content webserver together with the corresponding database as one of the backstage

elements to allow online course content offering by selecting the relevant option provided (Strongly agree, Agree, Not sure, Disagree or Strongly disagree). As can be seen from Table 6.7.13 and Figure 6.7.13, all participants (100%) were of the view that it is essential to have course content webserver together with the corresponding database as one of the backstage elements to allow online course content offering.

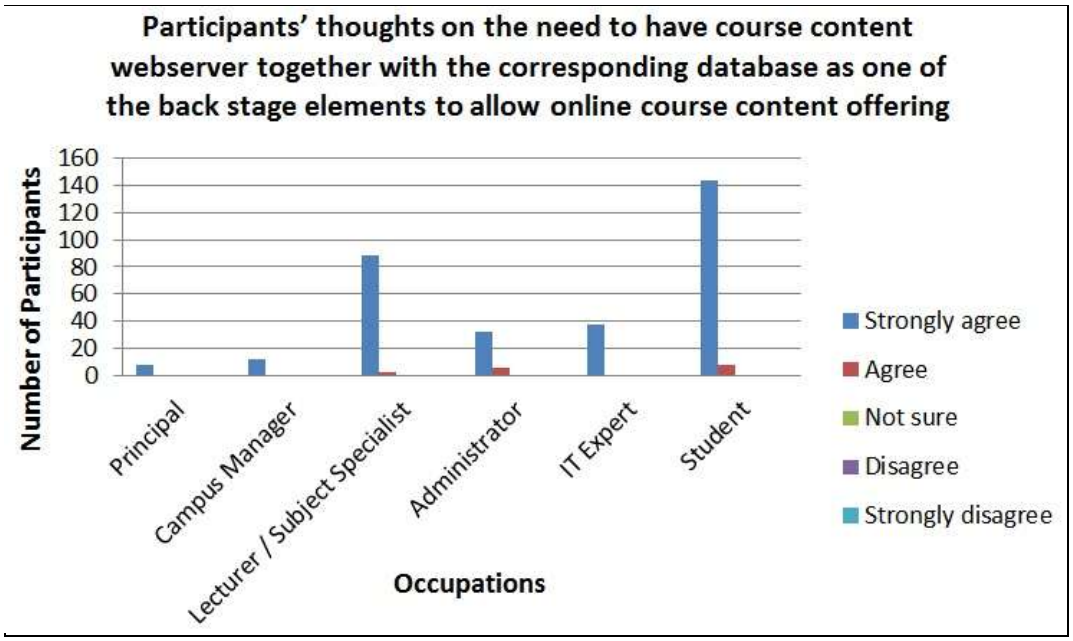

Figure 6.7.13: The need to have course content webserver together with the corresponding database

6.7.14. It is essential to have communication webserver together with the corresponding database as one of the backstage elements to allow online communication among stakeholders

Occupation	Strongly agree	%	Agree	%	Not sure	%	Disagree	%	Strongly disagree	%
Principal	8	2.4	0	0	0	0	0	0	0	0
Campus Manager	12	3.5	0	0	0	0	0	0	0	0
Lecturer / Subject Specialist	66	19.5	25	7.4	0	0	0	0	0	0
Administrator	37	10.9	1	0.3	0	0	0	0	0	0
IT Expert	31	9.1	7	2.1	0	0	0	0	0	0
Student	133	39.2	19	5.6	0	0	0	0	0	0
Total	287	84.7	52	15.3	0	0	0	0	0	0

Table 6.7.14: The need to have communication webserver together with the corresponding database

The participants were requested to indicate if it is essential to have communication webserver together with the corresponding database as one of the backstage elements to allow online communication among stakeholders by selecting the relevant option provided (Strongly agree, Agree, Not sure, Disagree or Strongly disagree).

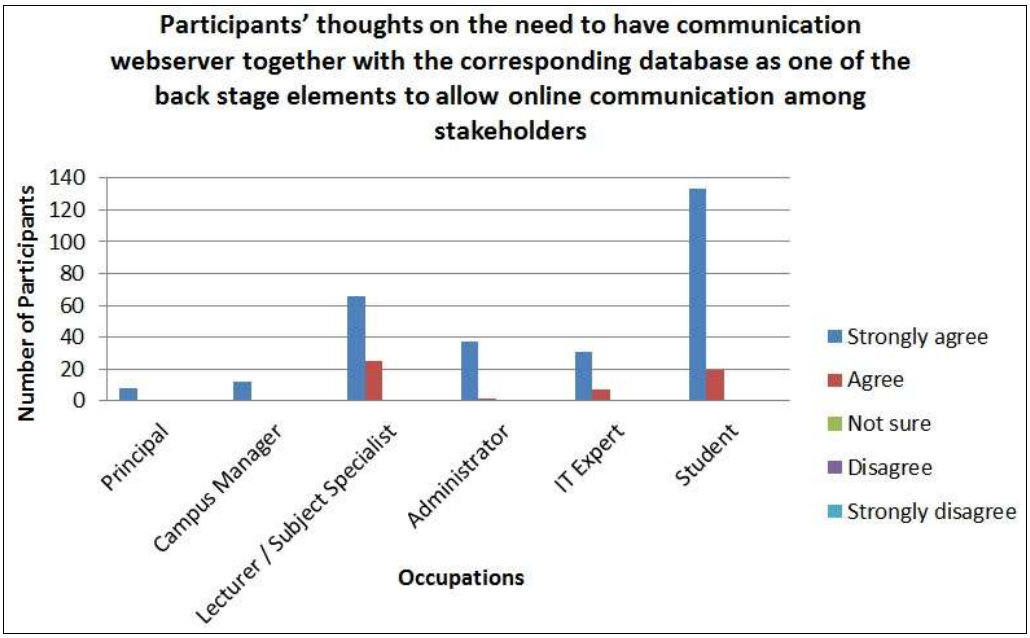

Figure 6.7.14: The need to have communication webserver together with the corresponding database

As can be seen from Table 6.7.14 and Figure 6.7.14, all participants (100%) participants are of the understanding that it is essential to have communication webserver together with the corresponding database as one of the backstage elements to allow online communication among stakeholders.

6.7.15. It is quite important to have assessment & results webserver together with the corresponding database as one of the backstage elements to allow online assessments and issuing of results

Occupation	Strongly agree	%	Agree	%	Not sure	%	Disagree	%	Strongly disagree	%
Principal	2	0.6	6	1.8	0	0	0	0	0	0
Campus Manager	0	0	12	3.5	0	0	0	0	0	0
Lecturer / Subject Specialist	74	21.8	17	5.0	0	0	0	0	0	0
Administrator	23	6.8	15	4.4	0	0	0	0	0	0
IT Expert	29	8.6	9	2.7	0	0	0	0	0	0
Student	78	23.0	74	21.8	0	0	0	0	0	0
Total	206	60.8	133	39.2	0	0	0	0	0	0

Table 6.7.15: The need to have assessment and results webserver together with the corresponding database

The participants were requested to indicate if it is quite important to have assessment and results webserver together with the corresponding database as one of the backstage elements to allow online assessments and issuing of results, by selecting the relevant option provided (Strongly agree, Agree, Not sure, Disagree or Strongly disagree).

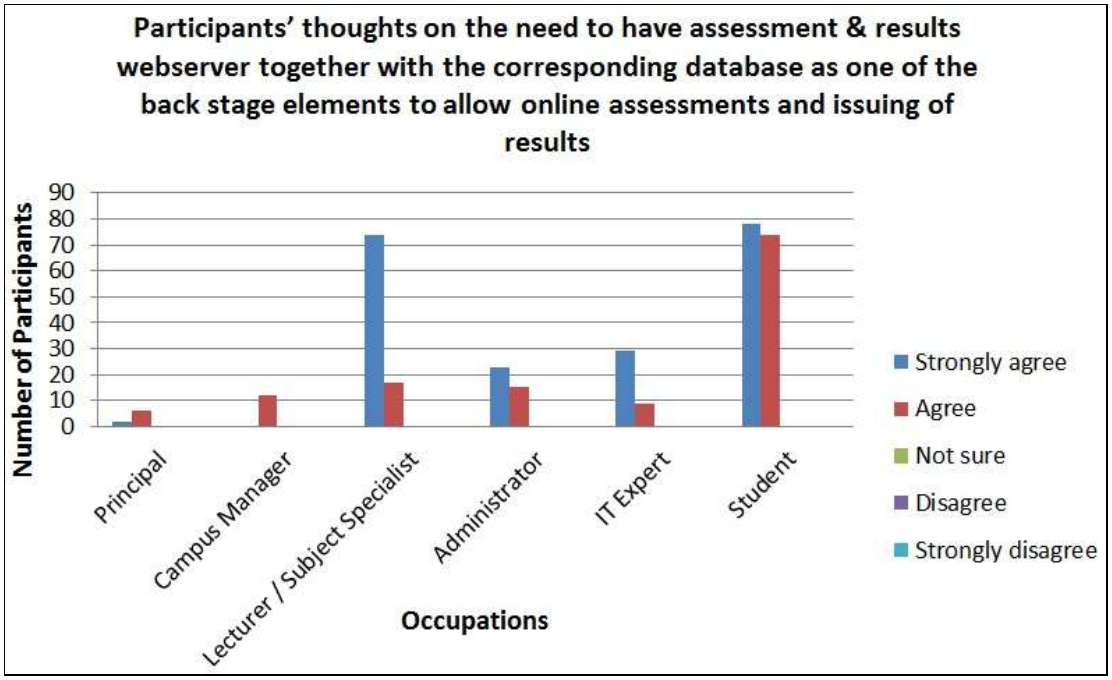

Figure 6.7.15: The need to have assessment and results webserver together with the corresponding database

As can be seen from Table 6.7.15 and Figure 6.7.15, all participants (100%) were of the view that it is quite important to have assessment and results webserver together with the corresponding database as one of the backstage elements to allow online assessments and issuing of results.

6.7.16. The observation and assessment of the conceptual technical building blocks should be continuous to ensure the best concept

Occupation	Strongly agree	%	Agree	%	Not sure	%	Disagree	%	Strongly disagree	%
Principal	8	2.4	0	0	0	0	0	0	0	0
Campus Manager	12	3.5	0	0	0	0	0	0	0	0
Lecturer / Subject Specialist	91	26.8	0	0	0	0	0	0	0	0
Administrator	38	11.2	0	0	0	0	0	0	0	0
IT Expert	38	11.2	0	0	0	0	0	0	0	0
Student	152	44.8	0	0	0	0	0	0	0	0
Total	339	100.0	0	0	0	0	0	0	0	0

Table 6.7.16: There should be continuous observation and assessment of the conceptual technical building blocks

The participants were requested to indicate if the observation and assessment of the conceptual technical building blocks should be continuous to ensure the best concept by selecting the relevant option provided (Strongly agree, Agree, Not sure, Disagree or Strongly disagree).

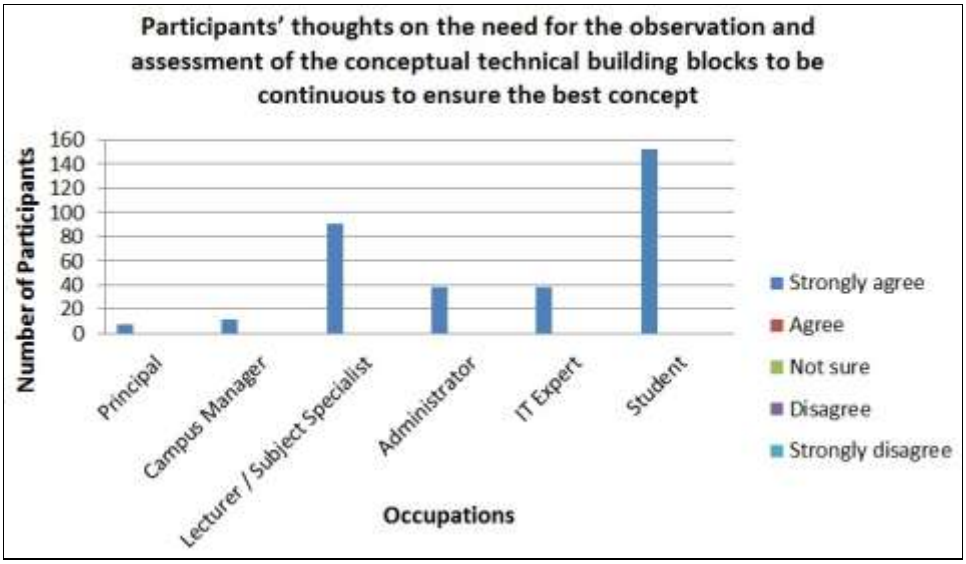

Figure 6.7.16: There should be continuous observation and assessment of the conceptual technical building blocks

As can be seen from Table 6.7.16 and Figure 6.7.16, all participants (100%) were of the view that the observation and assessment of the conceptual technical building blocks should be continuous to ensure the best concept.

6.8. Section F: E-Learning users' requirements

The intention of this section was to allow participants to contribute regarding e-learning users' requirements for the purpose of developing a prototype that meets stakeholders' needs for a better user experience in a real-life scenario.

6.8.1. The e-learning system should be responsive and adaptive (i.e. flexible) to allow access to it when using desktop/PC, laptop and mobile

Occupation	Strongly agree	%	Agree	%	Not sure	%	Disagree	%	Strongly disagree	%
Principal	8	2.4	0	0	0	0	0	0	0	0
Campus Manager	10	2.9	2	0.6	0	0	0	0	0	0
Lecturer / Subject Specialist	82	24.2	9	2.7	0	0	0	0	0	0
Administrator	17	5.0	21	6.2	0	0	0	0	0	0
IT Expert	28	8.3	10	2.9	0	0	0	0	0	0
Student	138	40.7	14	4.1	0	0	0	0	0	0
Total	283	83.5	56	16.5	0	0	0	0	0	0

Table 6.8.1: The e-learning system should be responsive and adaptive

The participants were requested to indicate if the e-learning system should be responsive and adaptive (i.e. flexible) to allow access to it when using desktop/PC, laptop and mobile devices, by selecting the relevant option provided (Strongly agree, Agree, Not sure, Disagree or Strongly disagree).

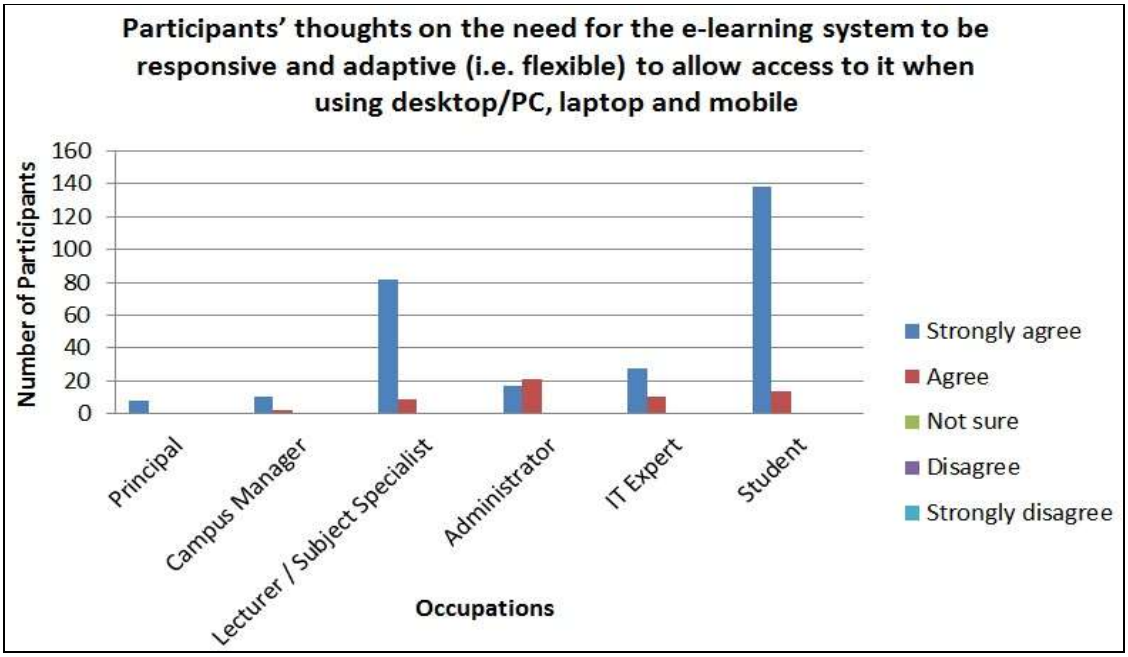

Figure 6.8.1: The e-learning system should be responsive and adaptive

As can be seen from Table 6.8.1 and Figure 6.8.1, all participants (100%) were of the view that the e-learning system should be responsive and adaptive (i.e. flexible) to allow access to it when using desktop/PC, laptop and mobile devices.

6.8.2. The campus, inter-campus and beyond campus network channels are appropriate for suitable access to e-learning

Occupation	Strongly agree	%	Agree	%	Not sure	%	Disagree	%	Strongly disagree	%
Principal	7	2.1	1	0.3	0	0	0	0	0	0
Campus Manager	9	2.7	3	0.9	0	0	0	0	0	0
Lecturer / Subject Specialist	25	7.4	61	18.0	5	1.5	0	0	0	0
Administrator	11	3.2	27	8.0	0	0	0	0	0	0
IT Expert	29	8.6	9	2.7	0	0	0	0	0	0
Student	113	33.3	39	11.5	0	0	0	0	0	0
Total	194	57.2	140	41.3	5	1.5	0	0	0	0

Table 6.8.2: Campus, inter-campus and beyond campus network channels are appropriate for suitable access to e-learning

The participants were requested to indicate if the campus, inter-campus and beyond campus network channels are appropriate for suitable access to e-learning by

selecting the relevant option provided (Strongly agree, Agree, Not sure, Disagree or Strongly disagree).

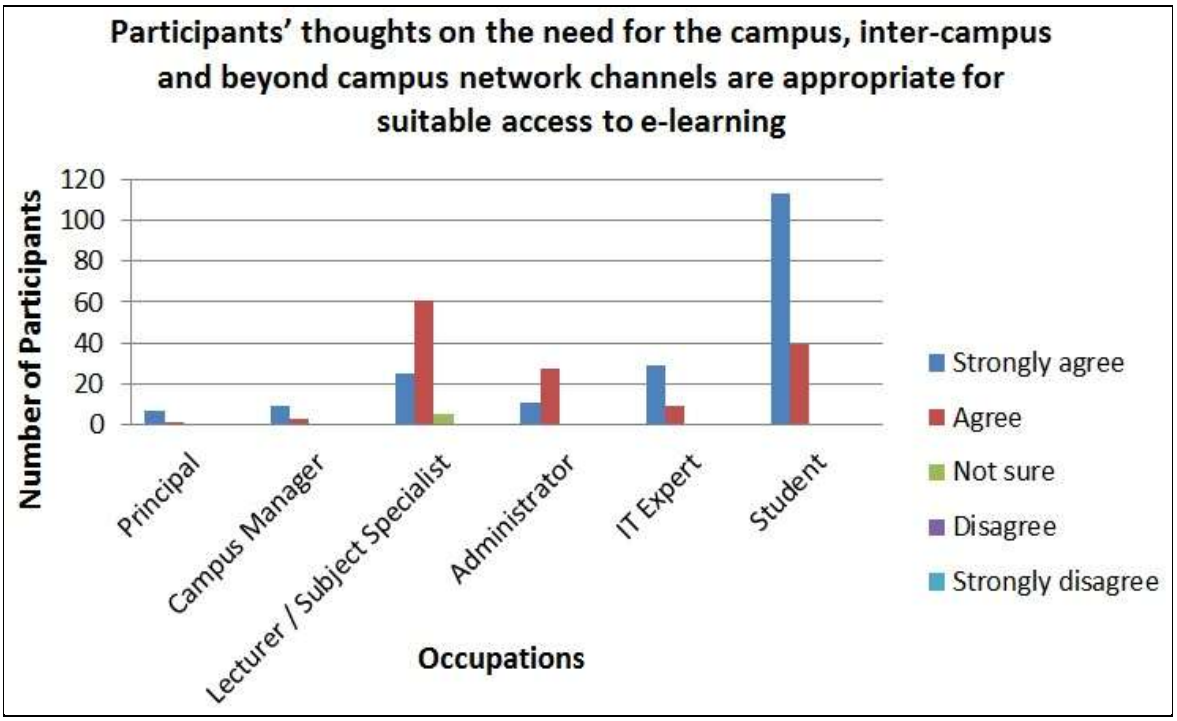

Figure 6.8.2: Campus, inter-campus and beyond campus network channels are appropriate for suitable access to e-learning

As can be seen from Table 6.8.2 and Figure 6.8.2, the majority of participants (334, 98.5%) were of the view that campus, inter-campus and beyond campus network channels are appropriate for suitable access to e-learning so as not to restrict access by geographical location, and 5 (1.5%) were not sure.

6.8.3. The student area should allow students to use features and functionalities

The question in the questionnaire listed the following features and functionalities: **Online application and registration** (incl. uploading documents, updating applications & registrations); **Access course content** (limited to modules enrolled for); **Communicate** (with Lecturers regarding academic affairs, administration personnel for administrative matters, and website master for technical/system support using e-mail, discussions and chats); **Assessment and results** (do assessments and receive results) and **System rating** (for students to assess the system).

Occupation	Strongly agree	%	Agree	%	Not sure	%	Disagree	%	Strongly disagree	%
Principal	3	0.9	5	1.5	0	0	0	0	0	0
Campus Manager	3	0.9	9	2.7	0	0	0	0	0	0
Lecturer / Subject Specialist	24	7.1	67	19.8	0	0	0	0	0	0
Administrator	9	2.7	29	8.6	0	0	0	0	0	0
IT Expert	23	6.8	15	4.4	0	0	0	0	0	0
Student	141	41.6	11	3.2	0	0	0	0	0	0
Total	203	59.9	136	40.1	0	0	0	0	0	0

Table 6.8.3: The student area should allow students to use features and functionalities

The participants were requested to indicate if the student area should allow students to use features and functionalities as mentioned above, by selecting the relevant option provided (Strongly agree, Agree, Not sure, Disagree or Strongly disagree). As can be seen from Table 6.8.3 and Figure 6.8.3, all participants (100%) are of the view that the student area should use the features and functionalities mentioned above to adequately allow students to learn as expected.

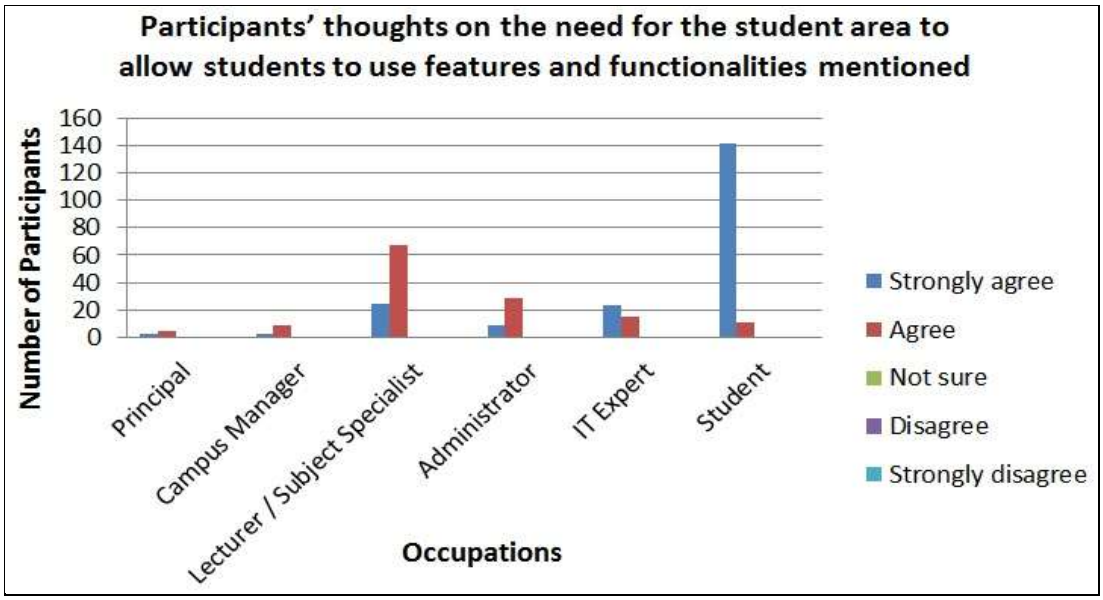

Figure 6.8.3: The student area should allow students to use features and functionalities

6.8.4. The lecturer area should allow lecturers to use features and functionalities

The question in the questionnaire listed the following features and functionalities: **Online application and registration** (access students assigned to them per module and keep track of students' online attendance); **Access course content** (be able to share with their students: video, presentation and documents); **Communicate** (with students for academic affairs, administration personnel for administrative matters, and website master for technical/system support using e-mail, discussions and chats); **Assessment and results** (upload and download assessments and issue the results to administration) and **System rating** (for lecturers to assess the system).

Occupation	Strongly agree	%	Agree	%	Not sure	%	Disagree	%	Strongly disagree	%
Principal	1	0.3	7	2.1	0	0	0	0	0	0
Campus Manager	4	1.2	8	2.4	0	0	0	0	0	0
Lecturer / Subject Specialist	31	9.1	60	17.7	0	0	0	0	0	0
Administrator	12	3.5	26	7.7	0	0	0	0	0	0
IT Expert	22	6.5	16	4.7	0	0	0	0	0	0
Student	143	42.2	9	2.7	0	0	0	0	0	0
Total	213	62.8	126	37.2	0	0	0	0	0	0

Table 6.8.4: The lecturer area should allow lecturers to use features and functionalities

The participants were requested to indicate if the lecturer area should allow lecturers to use features and functionalities as mentioned above by selecting the relevant option provided (Strongly agree, Agree, Not sure, Disagree or Strongly disagree).

As can be seen from Table 6.8.4 and Figure 6.8.4, all participants (100%) were of the view that the lecturer area should use the features and functionalities mentioned above to adequately allow lecturers to carry out their duties as expected.

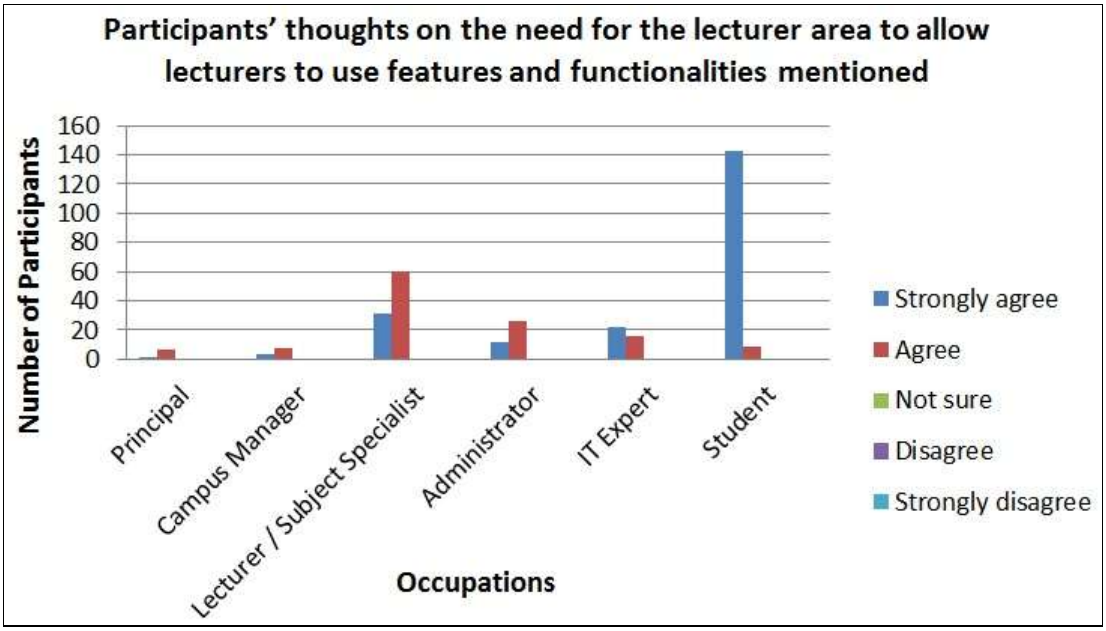

Figure 6.8.4: The lecturer area should allow lecturers to use features and functionalities

6.8.5. The admin area should allow admin personnel to use features and functionalities

The question in the questionnaire listed the following features and functionalities: **Online application & registration** (access students assigned to them per module and keep track of students' online attendance); **Access course content** (be able to share with their students: video, presentation and documents); **Communicate** (with students for academic affairs, administration personnel for administrative matters, and website master for technical/system support using e-mail, discussions and chats); **Assessment and results** (upload and download assessments and issue the results to administration) and **System rating** (for administrators to assess the system).

Occupation	Strongly agree	%	Agree	%	Not sure	%	Disagree	%	Strongly disagree	%
Principal	1	0.3	7	2.1	0	0	0	0	0	0
Campus Manager	2	0.6	10	2.9	0	0	0	0	0	0
Lecturer / Subject Specialist	33	9.7	58	17.1	0	0	0	0	0	0
Administrator	14	4.1	24	7.1	0	0	0	0	0	0
IT Expert	19	5.6	19	5.6	0	0	0	0	0	0
Student	140	41.3	12	3.5	0	0	0	0	0	0
Total	209	61.7	130	38.3	0	0	0	0	0	0

Table 6.8.5: The admin area should allow admin personnel to use features and functionalities

The participants were requested to indicate if the admin area should allow admin personnel to use features and functionalities as mentioned above by selecting the relevant option provided (Strongly agree, Agree, Not sure, Disagree or Strongly disagree).

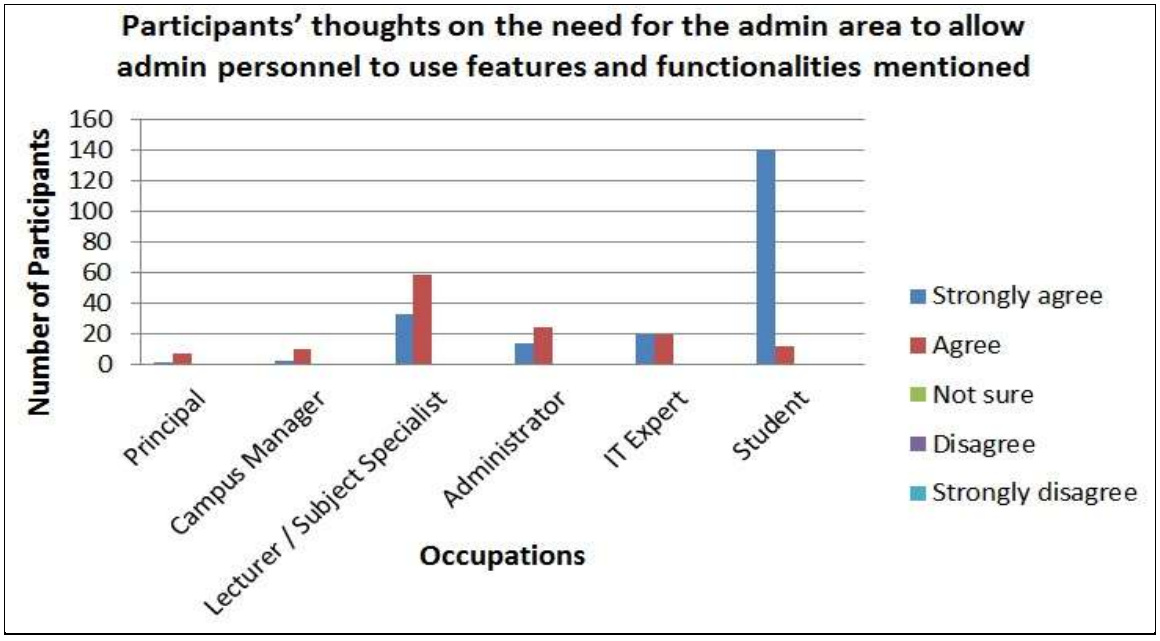

Figure 6.8.5: The admin area should allow admin personnel to use features and functionalities

As can be seen from Table 6.8.5 and Figure 6.8.5, all participants (100%) the participants are of the idea that the admin area should use features and functionalities mentioned above to adequately allow administrative personnel to carry their admin duties as expected.

6.8.6. The website master area should allow technical/system support to use features and functionalities

The question in the questionnaire listed the following features and functionalities: **Online application and registration** (offer technical/system support using e-mail, discussions and chats); **Access course content** (offer technical/system support using e-mail, discussions and chats); **Communicate** (offer technical/system support using e-mail, discussions and chats); **Assessment and results** (offer technical/system support using e-mail, discussions and chats) and **System rating** (for website master to assess the system).

Occupation	Strongly agree	%	Agree	%	Not sure	%	Disagree	%	Strongly disagree	%
Principal	1	0.3	7	2.1	0	0	0	0	0	0
Campus Manager	1	0.3	11	3.2	0	0	0	0	0	0
Lecturer / Subject Specialist	35	10.3	56	16.5	0	0	0	0	0	0
Administrator	11	3.2	27	8.0	0	0	0	0	0	0
IT Expert	22	6.5	16	4.7	0	0	0	0	0	0
Student	143	42.2	9	2.7	0	0	0	0	0	0
Total	213	62.8	126	37.2	0	0	0	0	0	0

Table 6.8.6: The website master area should allow technical/system support to use features and functionalities

The participants were requested to indicate if the website master area should allow technical/system support to use features and functionalities as mentioned above, by selecting the relevant option provided (Strongly agree, Agree, Not sure, Disagree or Strongly disagree). As can be seen from Table 6.8.6 and Figure 6.8.6, all participants (100%) were of the view that the website master area should be able to use the features and functionalities mentioned above to adequately allow technical/system support.

(Dale, 2011), spoke about KS barriers comprising three categories, namely, individual, organisational and technological barriers. One of the technological barriers is the absence of technical support and instant repairs of incorporated IT systems which then disturbs work procedures and communication. The respondents seemed to eliminate this barrier by supporting the idea that the website master area

should use the features and functionalities mentioned above to adequately allow technical/system support.

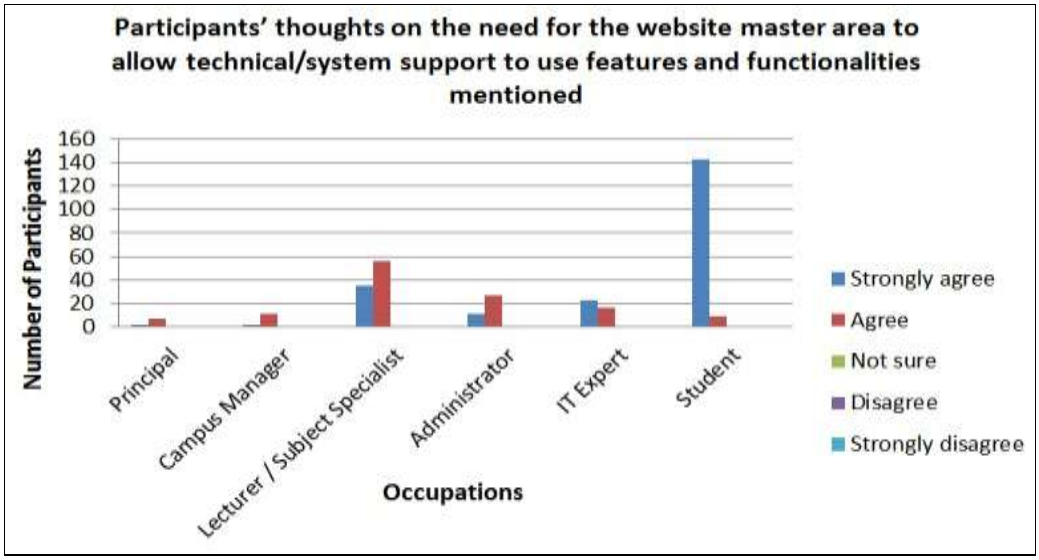

Figure 6.8.6: The website master area should allow technical/system support to use features and functionalities

6.8.7. The observation and assessment of the e-learning users' requirements should be conducted regularly to continuously improve the features and functionalities of the system

Occupation	Strongly agree	%	Agree	%	Not sure	%	Disagree	%	Strongly disagree	%
Principal	8	2.4	0	0	0	0	0	0	0	0
Campus Manager	12	3.5	0	0	0	0	0	0	0	0
Lecturer / Subject Specialist	91	26.8	0	0	0	0	0	0	0	0
Administrator	38	11.2	0	0	0	0	0	0	0	0
IT Expert	38	11.2	0	0	0	0	0	0	0	0
Student	149	44.0	3	0.9	0	0	0	0	0	0
Total	336	99.1	3	0.9	0	0	0	0	0	0

Table 6.8.7: Observation and assessment of the e-learning users' requirements should be conducted regularly

The participants were requested to indicate if observation and assessment of the e-learning users' requirements should be conducted regularly to continuously improve the features and functionalities of the system by selecting the relevant option provided (Strongly agree, Agree, Not sure, Disagree or Strongly disagree).

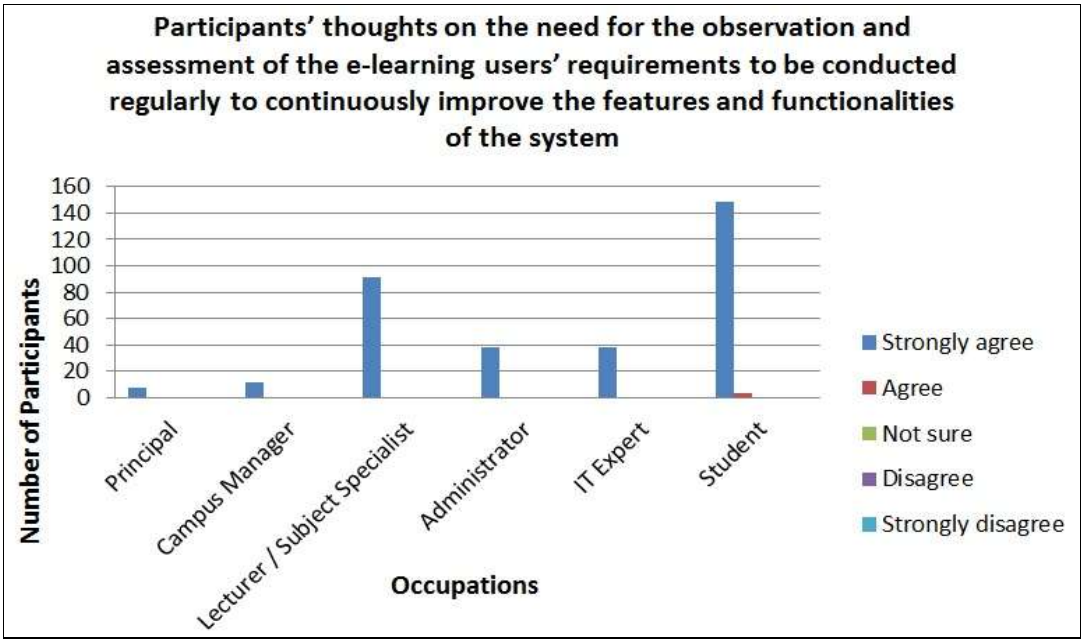

Figure 6.8.7: Observation and assessment of the e-learning users' requirements should be conducted regularly

As can be seen from Table 6.8.7 and Figure 6.8.7, all participants (100%) were of the view that the monitoring and evaluation of the e-learning users' requirements should be conducted regularly to continuously improve the features and functionalities of the system because technology and users' needs may change from time to time.

6.9. Conclusion

The aim of this chapter was to analyse the data obtained from the survey respondents as they evaluated and validated the proposed framework presented in Chapter 4. The presentation of results and data analysis has been successfully achieved. The major change brought about by stakeholders to the proposed framework was the removal of online application and registration which can only be considered in the future. Another highlight was for e-learning to be introduced as a supplement to face-to-face learning. The respondents indicated that internet access in terms of connectivity and speed is fairly poor in TVET colleges and requires improvement.

The next chapter presents the improved framework from which an architectural design and system prototype was developed.

7. An E-learning Prototype

7.1. Introduction

This chapter complements the objective on the development of a framework and the evaluation and validation of the framework by first delivering an improved framework based on findings from the survey, and also demonstrating that the framework can be implemented by forming an architecture then translating that architecture into a prototype of an e-learning system.

This chapter focuses on the findings and recommendations that are based on the interpretations in Chapter 6 derived from responses made by survey participants. These responses form key findings that warrant the attention of the study and can be relied upon to improve the proposed framework shown in Chapter 4. This chapter is not necessarily about the improved framework only but also looks at the design of the framework architecture based on the findings. Part of the survey (Section F) was aimed at identifying the requirements for a framework that are acceptable to end-users in order to provide an appropriate architectural design. This chapter includes appropriate software architecture required to handle the said requirements, the non-functional requirements and framework prototype depicting the technical requirements of the future system to help guide TVET colleges interested in adopting e-learning.

7.2. Key findings and recommendations

The key findings and recommendations are broken down into sections according to the survey. They are presented in the sections below which are sections 7.2.1, 7.2.2, 7.2.3, 7.2.4 and 7.2.5.

7.2.1. Internet usage and availability in education

The main objective of this study is to develop an e-learning framework for facilitating KS and CoP in TVET colleges. According to (Khan, 2005), institutions must engage

in self-assessment processes to establish their own evaluation of technological learning (e-learning) readiness and possible future enhancements. For that reason, it was necessary to check internet usage and availability in the participating TVET colleges as a starting point. It has been established that all the colleges who participated in the study do have internet. However, (230, 67.8%) out of 339 respondents indicated that internet connectivity and speed is poor at their campuses/colleges. It is therefore recommended that internet connectivity and speed must be improved for these colleges to be ready to offer internet-based learning.

The other finding was that most staff and students (200, 59%) access the internet in the internet room or office and Wi-Fi (15, 4.4%) located within the campus/college. This means that both staff and students need to be at the campus to access the internet and this does not solve the problems associated with the use of only face-to-face learning which is limited in terms of time and geographic location. No interaction with the lecturer beyond the classroom. Respondents who use laptops and mobile devices to access the internet may find it hard to maintain data due to the cost as none of the colleges provide data. It is also recommended that colleges should increase access to internet via laptops and/or mobile device and fund these in order to ensure that staff and students are able to access learning resources beyond the classroom or campus.

7.2.2. Importance of e-Learning

This section of the survey aims to check the importance of e-learning in order to ascertain that e-learning could indeed be considered as a powerful instrument aimed at overcoming existing challenges on the traditional face-to-face learning approach. The findings revealed that face-to-face is the only learning practice used in participating campuses/colleges. The results showed that TVET colleges want e-learning introduced as a complement to face-to-face in order to minimise its shortcomings. Substituting face-to-face with e-learning was turned down by the participants.

7.2.3. Theoretical foundation of learning

This section of the survey seeks to evaluate the theoretical foundation of learning (i.e. e-learning building blocks) in order to confirm its strategic importance in drafting KS instruments needed for a successful and resourceful e-learning procedure. The results revealed that pedagogy, ethics, institutional issues, resource support, industry engagement, interface design and technology should be utilised as part of the theoretical foundation of learning when adopting e-learning. This shows that participants are of the view that online learning must also be guided by rules and regulations in the same way that face-to-face learning is.

7.2.4. Conceptual technical building blocks

The intention of this section is to assess the conceptual technical building blocks (i.e. facilitation of e-learning) in order to check the importance of KS principles to ensure that they are incorporated into an e-learning framework for the system to meet the stakeholders' needs, especially the learners. This section comprised five layers, namely, terminals, front-end portals, network channels, webservers and databases. The results reveal that participants are in support of these five layers as shown in the proposed conceptual framework shown in section 4.7. However, most administrative personnel who participated in the study still prefer doing applications and registrations manually. It is recommended that applications and registrations be excluded from the framework now and it may be considered in the future should their needs change as monitoring and evaluation has been approved by all TVET stakeholders.

7.2.5. E-Learning users' requirements

The intention of this section is to allow participants to contribute on e-learning users' requirements for the purpose of developing a prototype that meets stakeholders' needs for a better user experience in a real-life scenario. The focus here is on the need of the end-users with regards to features and functionalities. The TVET stakeholders have approved features and functionalities of students, lecturers, administration personnel and webmaster front-end portals as listed below:

The student area should have the following features and functionalities laid out in Table 7.2.5-1.

Access course content: students should access the course content only for the modules/subjects enrolled for	**Communicate:** students should be able to communicate with lecturers regarding academic affairs, administration personnel for administrative matters, and webmaster for technical/system support using e-mail, discussions and chats	**Assessment and Results:** students should be able to do assessments, submit them and receive results by means of e-learning	**Monitoring and Evaluation:** for students to assess the system

Table 7.2.5-1: Features and functionalities of the student area

The lecturer area should allow lecturers to use features and functionalities as laid out in Table 7.2.5-2.

Access course content: lecturers should be able to share with their students learning material in the form of videos, presentations and documents	**Communicate:** lecturers should be able to communicate with students regarding academic affairs, administration personnel for administrative matters, and webmaster for technical/system support using e-mail, discussions and chats	**Assessment and Results:** set assessments, mark students' scripts and make results available to administration personnel	**Monitoring and Evaluation:** for lecturers to assess the system

Table 7.2.5-2: Features and functionalities of the lecturer area

The admin area should allow admin personnel to use features and functionalities as laid out in Table 7.2.5-3.

Access course content: administration personnel should ensure course content and study material is available to students together with additional resources	**Communicate:** communicate with lecturers regarding academic affairs, students for administrative matters, and webmaster for technical/system support using e-mail, discussions and chats	**Assessment and Results** – administration personnel to upload and download assessments and make the results available to students after marking has been done by the lecturer concerned	**Monitoring and Evaluation:** for administrators to assess the system

Table 7.2.5-3: Features and functionalities of the admin personnel area

The webmaster area should allow technical/system support to use features and functionalities as laid out in Table 7.2.5-4.

Access course content: offer technical/system support using e-mail, discussions and chats	**Communicate:** offer technical/system support using e-mail, discussions and chats	**Assessment and Results:** offer technical/system support using e-mail, discussions and chats	**Monitoring and Evaluation:** for website masters to assess the system

Table 7.2.5-4: Features and functionalities of the webmaster area

The improved framework in section 7.3, was developed according to the findings above.

7.3. The improved e-Learning framework

This section focuses on presenting the improved framework. The improved framework emanates from the responses made by TVET stakeholders as they were evaluating the proposed framework developed from the existing research using a survey.

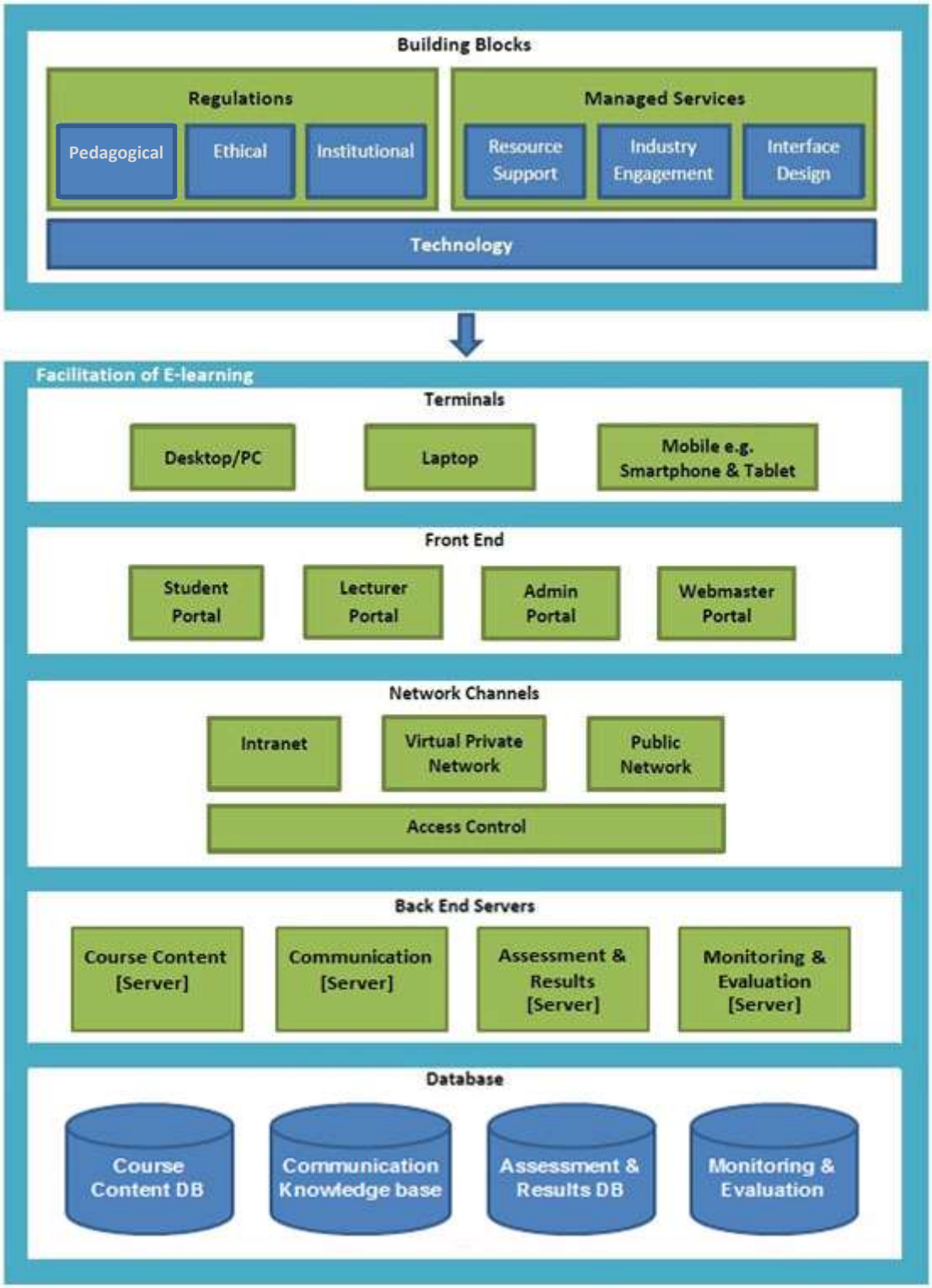

Figure 7.3: The improved e-learning framework

The only change made in this framework from the proposed one was to exclude the applications and registrations server together with the corresponding database. This change comes as the result of most administrative personnel's lack of support for

online applications and registrations. The improved framework is made up of six categories as described below.

Building blocks which is made up of eight dimensions which are sometimes considered as factors. Every dimension signifies a class of concerns that must be attended to, in order to create fruitful experiences. The dimensions are Pedagogical, Technological, Interface, Evaluation, Management, Resource support, Ethical and Institutional (refer to sub-section 4.7.1 for more details). **Terminals** refer to devices that an e-learning system is supposed be compatible with, which can be used by end-users to access the system. The devices are PC/desktop, laptop and mobile devices i.e. tablets, smartphones. **Front-end portals** refer to the face of the system which is what the users see on the system. The recommended system portals are Student portal, Lecturer portal, Admin portal and Webmaster portal. **Network channels** refer to the networks to be used in order to access the system. The network channels are Intranet, Virtual Private Network and Public Network; together with Access Control to ensure that only authorised personnel access the system. **Back-end servers** which provide the end-users with services they may come to expect from the system. The servers are Application and Registration Web Server, Course Content Server, Communication Server, and Assessment and Results Server. **Database** refers to the storage to be used to keep system information. The databases are Application and Registration Database, Course Content Database, Communication Database, and Assessment and Results Database. The architectural design follows in section 7.4 to indicate the interaction among framework components/categories.

Based on the improved framework, the architectural model was developed as shown in section 7.4.

7.4. The architectural design

The architectural design in Figure 7.4 shows the relationship or interaction among framework components/categories of an e-learning framework.

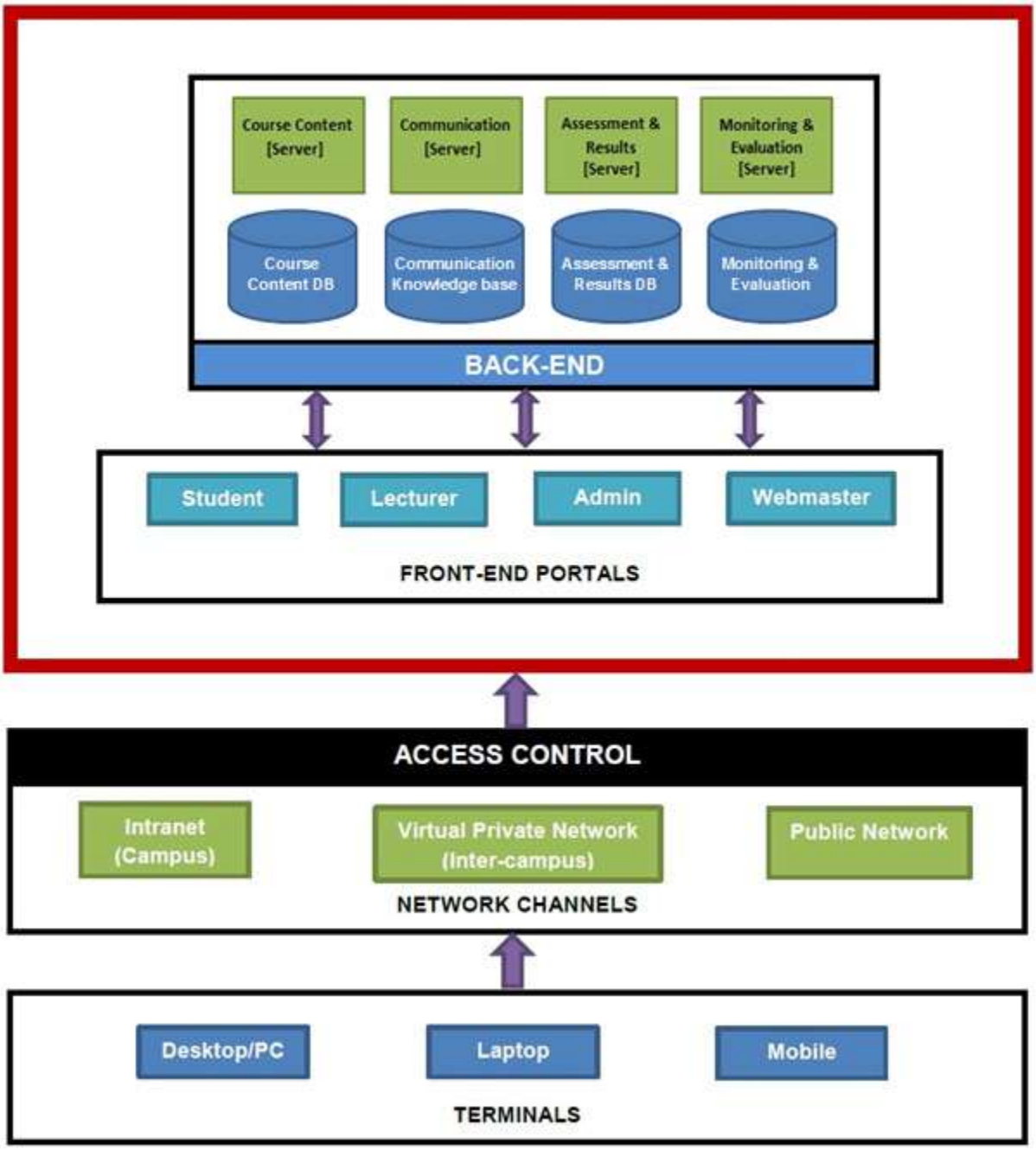

Figure 7.4: The architectural design

The flow starts from one of the terminal devices which may be a desktop/PC, laptop or mobile device which needs to connect to the network either via intranet or VPN or public network depending on the location. Once the terminal device is connected to the network, it is ready to access the system provided that the user (i.e. student, lecturer, admin or webmaster) is authorised to access the system. As soon as the user gains access to the system she/he may then make use of the services available from the system which is student portal for a student, lecturer portal for a lecturer,

admin portal for an admin personnel or webmaster portal for a webmaster. The services are obtained from the back-end servers which are Course Content webserver, Communication webserver and Assessment and Results webserver together with the corresponding databases which are responsible for keeping the information. The system requirements with regards to user and software are offered in sub section 7.5.1.2. below. The end-users receive services from the webservers through the front-end portals meaning that end-users interact with the front-end portals in order to obtain services from the webservers and corresponding databases.

7.5. E-learning system

Below are the software development life cycle (SDLC) phases into which a framework prototype that demonstrates the flow and functionality of an improved e-learning framework was developed. The SDLC is made up of six phases, namely: requirements gathering and analysis, design (framework prototype), implementation or coding, testing, deployment and maintenance. The phases are in the order in which they are performed. Every phase produces deliverables needed by the succeeding phase in the lifecycle. The requirements are turned into design. Coding is done according to the design which is referred to as implementation or coding phase. After implementation or coding, testing validates the deliverable of the implementation phase against requirements. Once testing is done, deployment of the system takes place and finally the system undergoes maintenance. These phases are carried out whenever the system's requirements change (ISTQBExamCertification.com, 2014).

7.5.1. Requirements gathering and analysis

The institutional learning requirements are collected in this phase. The focus of this phase should be on the developers and TVET stakeholders. The gatherings with developers and TVET stakeholders should be held to decide on requirements such as "What information should be produced by the system?" "Who is going to use the system?" "What information should be captured to the system?" "How will they use

the system?" These are common questions that should be responded to through a requirements collecting phase. Once the requirements are collected, they need to be analysed to check the validity and the feasibility of integrating them into the system to be developed. To conclude, a requirement specification document is produced which works as the guide for the following phase of the prototype.

7.5.1.1. User requirements

It is crucial to know the user requirements and the intended uses of the system when planning to develop a system. Other requirements such as software requirements, hardware requirements and non-functional requirements rely on user requirements because what the user needs determine software, hardware and non-functional needs. Features and functionalities for the student area are laid out in Table 7.2.5-1, for the lecturer area in Table 7.2.5-2, for the administration area in Table 7.2.5-3 and for the webmaster area in Table 7.2.5-4.

7.5.1.2. Hardware and software requirements

The minimum requirements for an online system which can be able to deliver the expected user requirements and intended system uses mentioned on section 7.5.1.1 are **Software:** Apache Server 2.2 or newer, MySQL 5.5.31 or newer, PHP 5.4.6 or newer and web browsers (Internet Explorer 9 or newer, Safari 4 or newer, Firefox 3.5 or newer, Google Chrome 4 or newer and Opera 10.5 or newer) and **Hardware:** Processor 1GHz or faster, RAM 1GB or more (32bit) or 2GB or more (64bit) and hard disk space 16GB or more (32bit) or 20GB or more (64bit) (Manchanda & Shabna, 2013).

7.5.1.3. Non-functional requirements of the future system

According to (Chung, 2010), non-functional requirements do not describe what the programs should accomplish, but rather how they should accomplish it; for instance, design constraints, program external interface requirements, program performance requirements, and program quality features. They are challenging to assess and for that reason, they are commonly assessed subjectively.

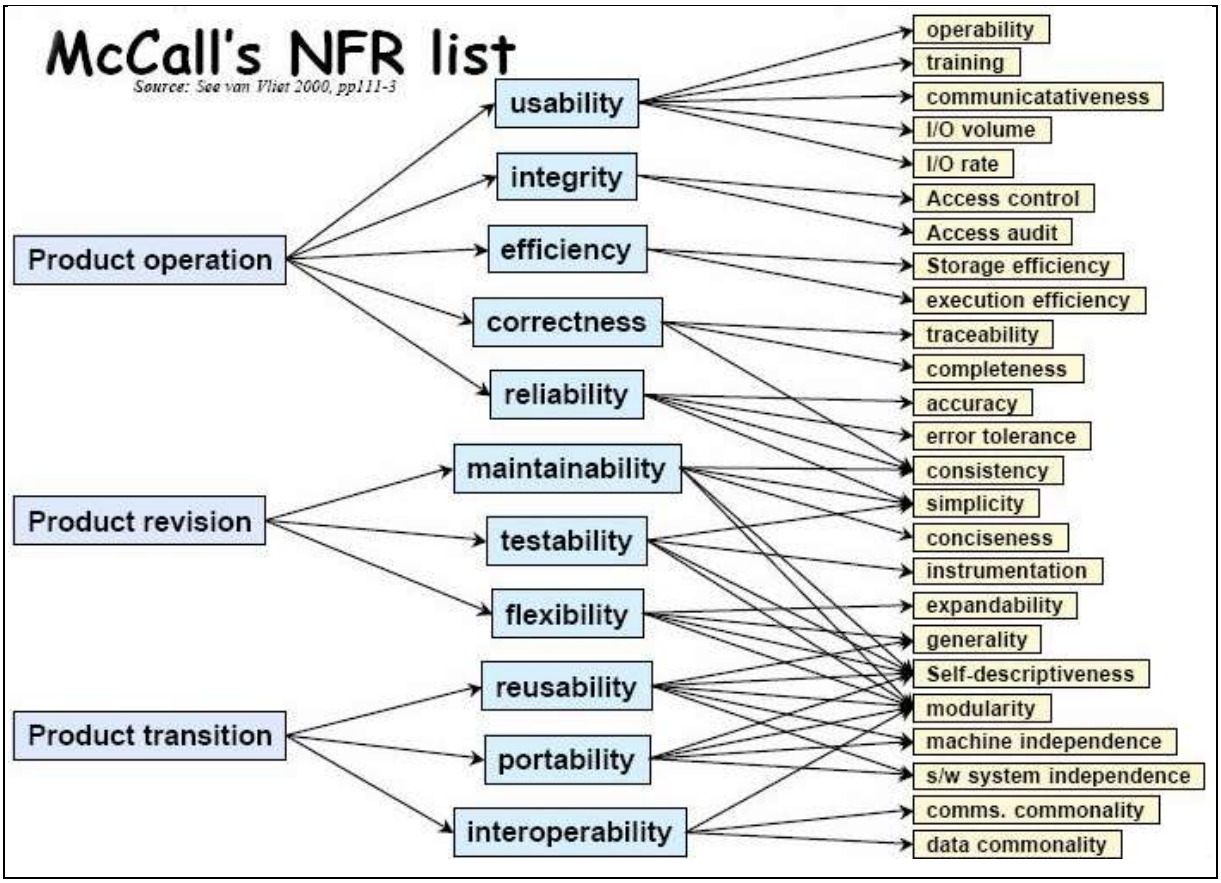

Figure 7.5.1.3: The list of Non-Functional Requirements by (Vliet, 2000)

Figure 7.5.1.3 shows a list of non-functional requirements to ensure the best system performance (Vliet, 2000). According to (Vliet, 2000), these requirements are divided into three main categories, namely, product operation, product revision and product transition. The first category (product operation) focuses on the system's usability, integrity, efficiency, correctness and reliability. The system's usability is important in ensuring that it is easy to use the system in order to have the best operability (ability to operate), training, communicativeness, I/O volume (Input/Output volume) and I/O rate (Input/Output rate). This category is achieved through consistency, simplicity, conciseness, instrumentation, expandability, generality, self-descriptiveness and modularity. The second category (product revision) focuses on the maintainability, testability and flexibility of the system. The third category (product transition) can be realised through generality, self-descriptiveness, modularity, machine independence, software system independence, communications commonality and data commonality.

7.5.2. Design (framework prototype)

(Legault, 2016), defines prototype as an early example of an e-learning course that provide designers with a hint of the basic appearance and impression together with the functionality of a product, without imitating every function or visual design. The prototype also shows the complete flow of the programme.

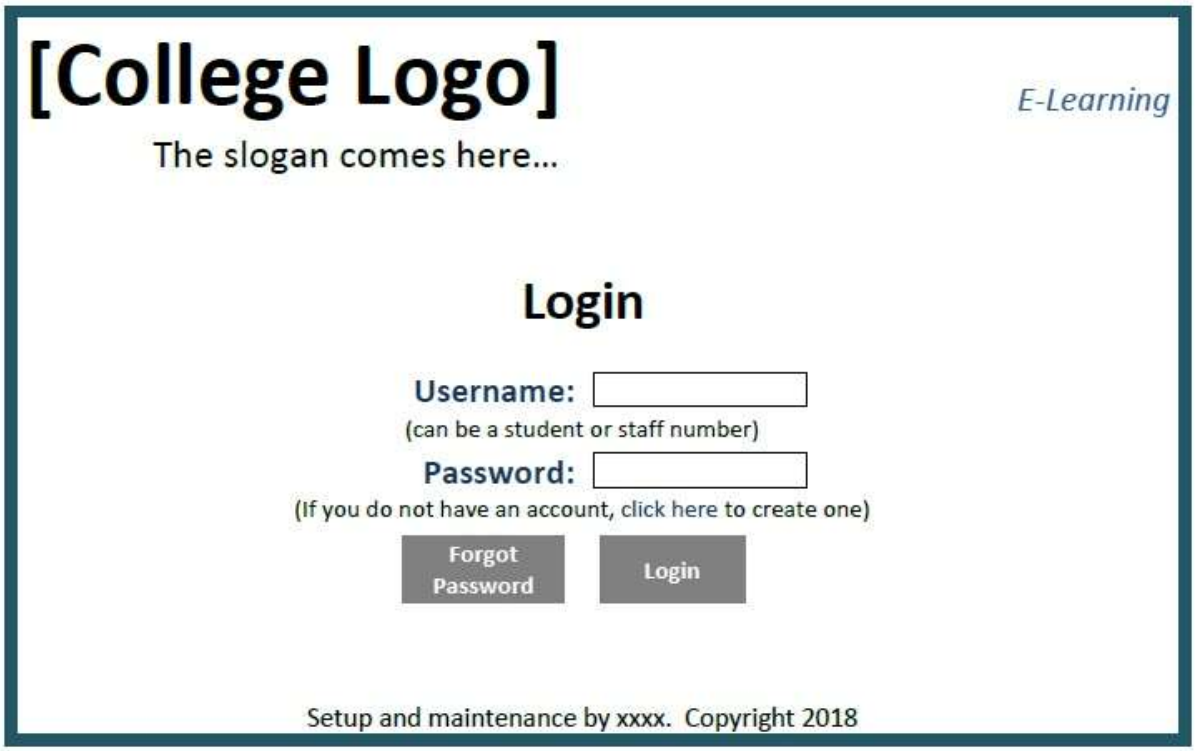

Figure 7.5.2-1: The login

This framework prototype shows the follow starting from the **login page** (see Figure 7.5.2-1) in which a student, lecturer, administration personnel or webmaster can login into their respective portals. This means that a student can be directed to student portal, lecturer to lecturer portal, admin to admin portal and webmaster to webmaster portal. The **student portal** (see Figure 7.5.2-2) becomes available to a student immediately after access has been granted through a successful login. The student portal is made up of six sections which are header, links, left panel, centre panel, right panel and footer. The header is the section of the website where the college logo and slogan should be positioned. The links section is the section of the website that is below the header where modules/subjects enrolled for can be displayed.

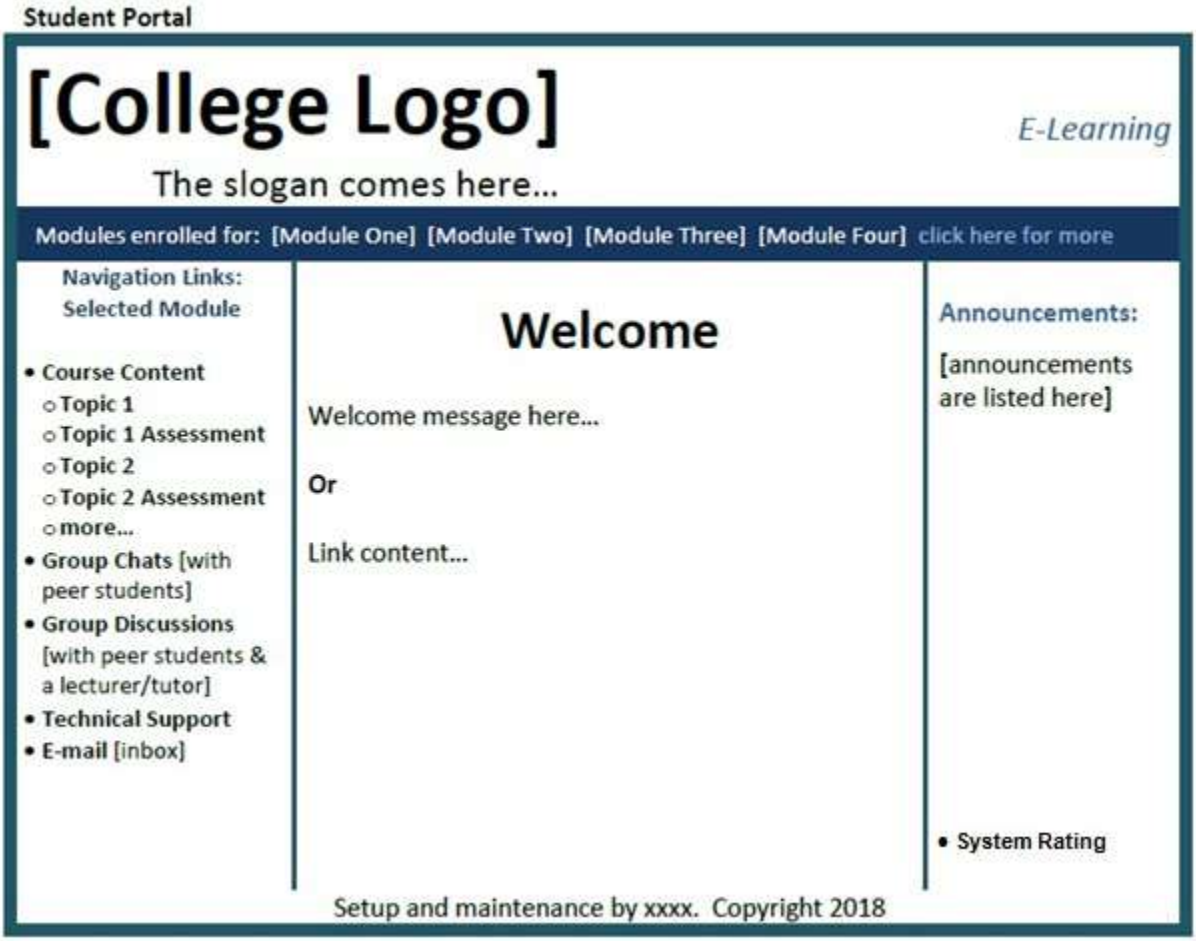

Figure 7.5.2-2: Student portal

The left panel is the section in which the navigation links of the selected module should be located. These navigation links allow the student to access services such as Course Content, Assessments, Group Chats, Group Discussions, Technical Support and E-mail (inbox). The centre panel is the section in which the welcome message and the contents associated with the navigation links should be displayed. The right panel section is where announcements are displayed and a system rating link should be available at the bottom of this panel for users to evaluate the system. The footer section should display the copyright statement of the website system.

The **lecturer portal** (see Figure 7.5.2-3) becomes available to a lecturer immediately after access has been granted through a successful login. The lecturer portal is made up of six sections which are header, links, left panel, centre panel, right panel and footer.

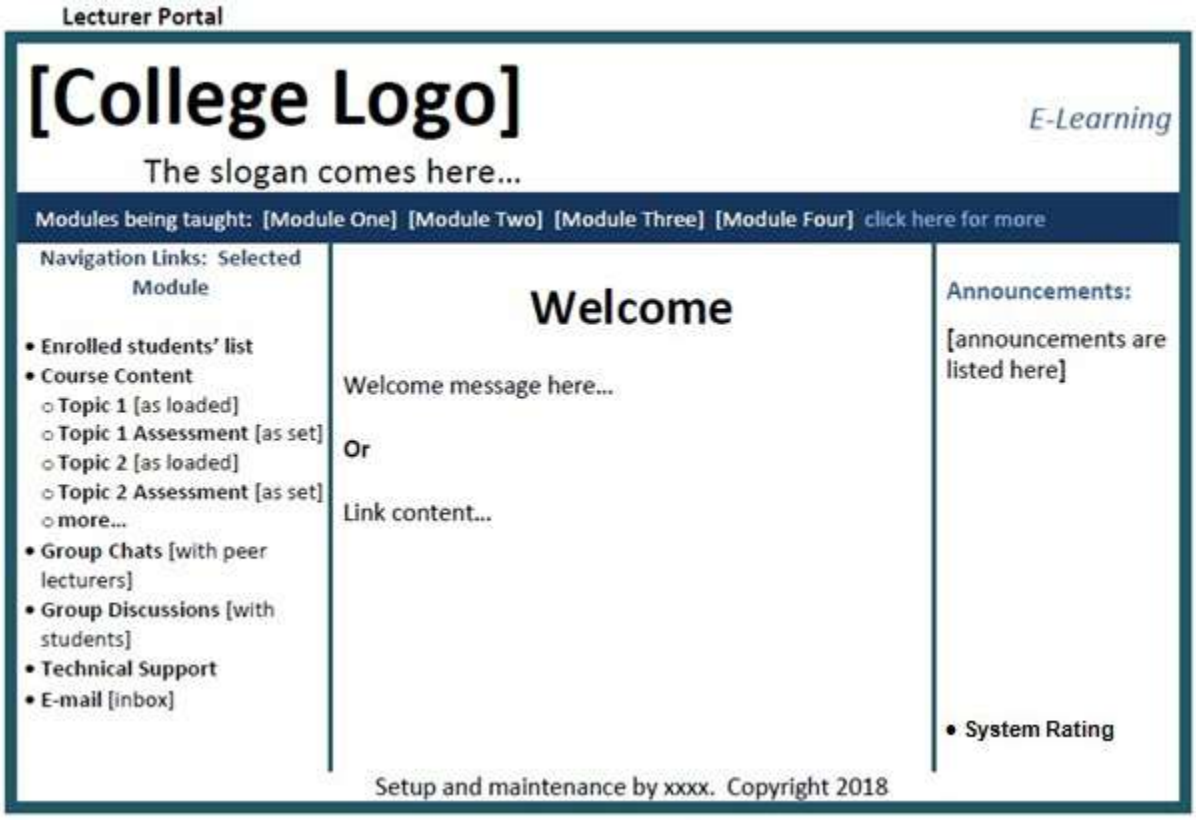

Figure 7.5.2-3: The lecturer portal

The header is the section of the website where the college logo and slogan should be positioned. The links section is the section of the website that is below the header where modules/subjects taught by a lecturer can be displayed. The left panel is the section in which the navigation links of the selected module should be located. These navigation links allow the lecturer to access services such as Enrolled students' list, Course Content (incl. uploading rights), Assessments (incl. uploading rights), Group Chats, Group Discussions, Technical Support and E-mail (inbox). The centre panel is the section in which the welcome message and the contents associated with the navigation links should be displayed. The right panel section is where announcements can be displayed and a system rating link should be available at the bottom of this panel for users to evaluate the system. The footer section should display the copyright statement of the website system. The **admin portal** (see Figure 7.5.2-4) becomes available to administration personnel immediately after access has been granted through a successful login. The admin portal is made up of six sections which are header, links, left panel, centre panel, right panel and footer.

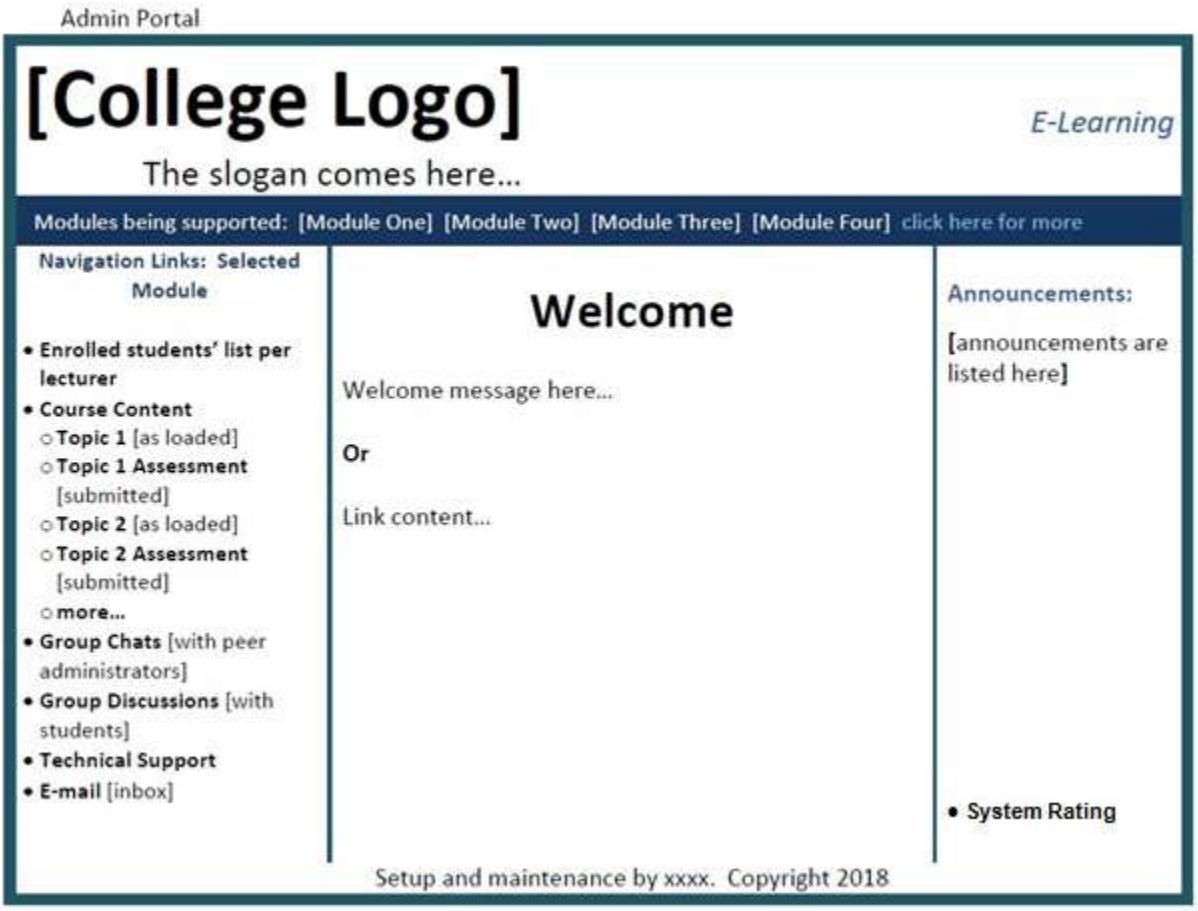

Figure 7.5.2-4: The admin portal

The header is the section of the website where the college logo and slogan should be positioned. The links section is the section of the website that is below the header where modules/subjects supported by administration personnel can be displayed. The left panel is the section in which the navigation links of the selected module should be located. These navigation links allow the administrator to access services such as Enrolled students' list per lecturer, Course Content (including uploading rights), Assessments (including uploading and downloading rights), Group Chats, Group Discussions, Technical Support and E-mail (inbox). The centre panel is the section in which the welcome message and the contents associated with the navigation links can be displayed. The right panel section is where announcements should be displayed and a system rating link should be available at the bottom of this panel for users to evaluate the system. The footer section should display the copyright statement of the website system. The **webmaster portal** (see Figure 7.5.2-5) becomes available to the webmaster immediately after access has been

granted through a successful login. The webmaster portal is made up of six sections which are header, links, left panel, centre panel, right panel and footer.

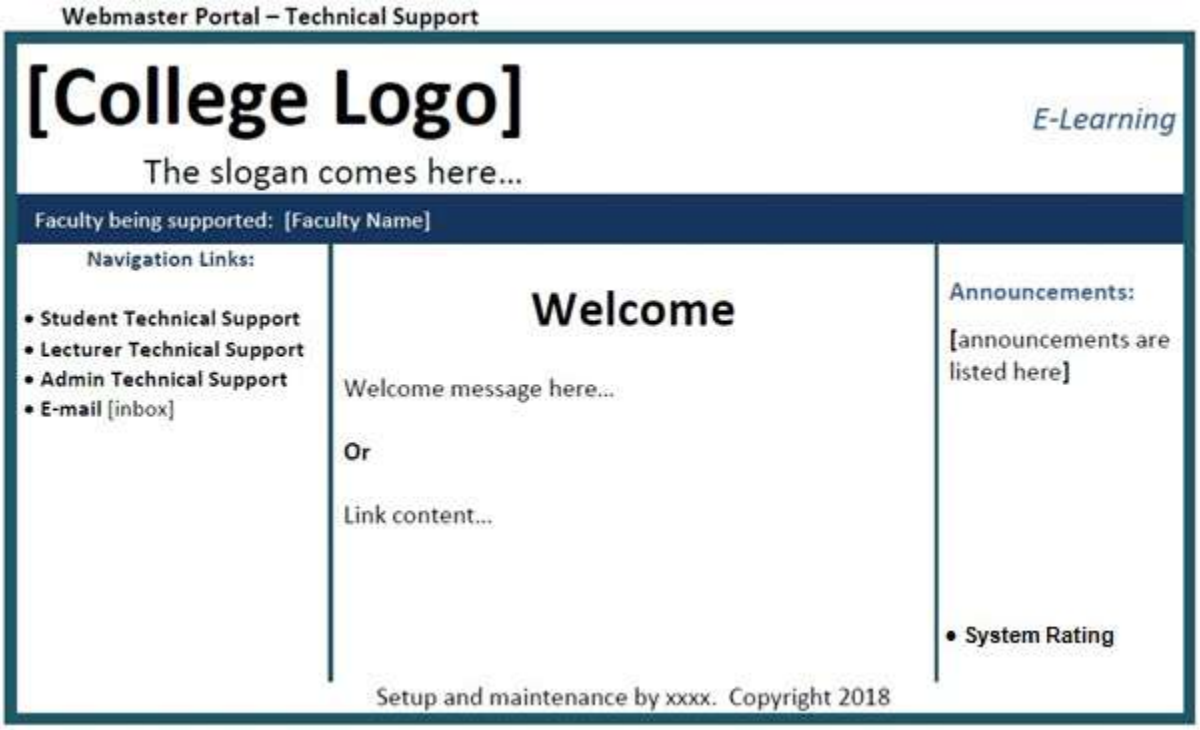

Figure 7.5.2-5: The webmaster portal

The header is the section of the website where the college logo and slogan should be positioned. The links section is the section of the website that is below the header where the faculty (ies) supported by the webmaster can be displayed. The left panel is the section in which the navigation links of the selected faculty can be located. These navigation links allow the webmaster to access services such as Student Technical Support (receive student queries), Lecturer Technical Support (receive lecturer queries), Admin Technical Support (receive admin queries) and E-mail (inbox). The centre panel is the section in which the welcome message and the contents associated with the navigation links should be displayed. The right panel section is where announcements should be displayed and a system rating link can be available at the bottom of this panel for users to evaluate the system. The footer section should display the copyright statement of the website system.

7.5.3. Implementation or coding (code generation)

Once the system design documents have been obtained, the work is broken down into smaller manageable components/units and real coding begins. The development of code is the main responsibility of the system developer or programmer and is the lengthiest phase of the software development life cycle.

7.5.4. Testing

Soon after the code has been generated, it is verified against the requirements to ensure that the system being developed is actually meeting the requirements raised and collected in the course of the requirements phase to better serve TVETs. Throughout this phase all kinds of functional testing such as system testing, integration testing, component testing, acceptance testing and non-functional testing is conducted.

7.5.5. Deployment

As soon as the testing becomes successful the system should be supplied to TVET colleges for use. Once the system has been offered to TVET colleges they first prepare the beta testing. Should any alterations be necessary or bugs be detected, these get reported to the development team. Once alterations are accomplished and the bugs resolved the ultimate deployment should occur.

7.5.6. Maintenance

When TVET colleges begin to use the developed system problems can arise and need to be fixed from time to time. The procedure for repairing the developed system is called maintenance. The e-learning system should undergo maintenance regularly for it to be continuously in good working order
(ISTQBExamCertification.com, 2014).

7.6. Conclusion

This chapter supplements sub-objectives 3 and 4 of the study with the focus on the formation of a framework and the evaluation and validation of the framework by first offering an improved framework based on findings from the survey and showing that the framework can be implemented by proposing an architecture, then converting the architecture into a prototype of the e-learning system.

This chapter concentrated on the findings and recommendations that are based on the analyses done in Chapter 6 resulting from responses made by survey participants. These replies generated key findings that warranted consideration in the study and can be relied upon to enhance the proposed framework shown in Chapter 4. This chapter was not only about the improved framework, but it also looked at the design of the framework architecture founded on the findings. Section F of the survey was intended for identifying the requirements of a framework that are valuable to end-users in order to offer a suitable architectural design. This chapter further looked at suitable software architecture necessary for the handling of the mentioned requirements, the non-functional requirements and framework prototype portraying the technical requirements of the upcoming system to guide TVET colleges whose intention is to implement e-learning. The next chapter presents the conclusion and future work.

8. Conclusion and Future Work

8.1. Introduction

This chapter aims to demonstrate to the reader how the main research objective was achieved by providing evidence on how each research question was answered which then contributed to the main research question and therefore achieve the main research objective. As part of the future work, the reader is informed of the possible avenues for further research going forward.

In an attempt to realise the objectives and to respond to research question of this study, a survey together with the literature review were used. Four hundred and thirty-two (432) questionnaires were given to TVET stakeholders which are principals/deputy principal: academic, campus managers, education specialists /lecturers, IT experts, administrators, and students from nine colleges one from each province; with two campuses from each college participating, one being located in an urban area and the other being located in a township. The research methodology suitable for this study was chosen following the literature review on the study topic, the setting of the main objective and sub-objectives, together with assessment of the existing research using a survey. The results were grounded on the main objective and sub-objectives of this research as listed below. The main objective of this study was to develop an e-learning framework for facilitating KS and community of practice in TVET colleges. This was achieved through the fulfilment of the specific sub-objectives listed below:

- **Sub objective 1:** To investigate the state of the art of KS in TVET colleges.
- **Sub objective 2:** To investigate the suitability of e-learning as a mechanism to overcome challenges faced by TVETs with regard to KS.
- **Sub objective 3:** To develop an e-learning framework, on which TVETs can rely to effectively and efficiently share knowledge among stakeholders.
- **Sub objective 4:** To evaluate and validate the framework in a real-life environment of identified TVET colleges.

The literature review was covered in Chapters 2, 3 and 4. The literature in Chapter 2 explored the current state of KS in TVETs where the face-to-face mode was found to

be the norm and challenges associated with it were discovered. Chapter 3 explored the literature on how e-learning can be utilised as an enabler for KS in TVET colleges. The fourth chapter presented the proposed e-learning framework for TVET colleges which was derived from the existing literature. Six aspects were derived from the literature review which were also used to guide the development of a survey. The six aspects were: biographical information, internet usage and availability in education, importance of e-learning, theoretical foundation of learning, conceptual technical building blocks and e-learning users' requirements.

The fifth chapter looked at how data was collected and in Chapter 6 the data from the survey respondents were analysed and results were produced. The seventh chapter presented the improved framework derived from the respondents' input. The improved framework was used to develop an architectural design and prototype as proof that the framework can be used in real-life. Lastly, Chapter 8 presents the overall conclusions of the study comprising the main research results, limitations, contributions to knowledge and recommends future research work.

8.2. Theoretical and methodological contribution

The success of this paper is dependent on its capability to contribute to the body of knowledge and practice (Missa, 2013). This research has eventually developed a conceptual framework and framework prototype suitable for TVET colleges which can be utilised as a guide in the development of an e-learning system thereby improving adoption of e-learning at TVET colleges. It is this main objective that has informed the input of this research to the body of knowledge and practice in the field of KS.

Subsequently, this paper has developed a new e-learning framework and framework prototype that strives to overcome barriers that are found in traditional face-to-face modes of KS. This research adds to the current KS literature by developing an e-learning framework to help enhance KS within TVETs. To the best of the investigator's knowledge, this paper is the first to be conducted in relation to public TVET colleges in South Africa. As a result, this research adds to the body of

knowledge in the DHET sector as it is associated with features that help in the adoption of the e-learning system within the higher education sector in South Africa. This research has made an effort to minimise the gap in knowledge between TVETs globally and South African TVET colleges by offering a guideline to support the adoption of e-learning within South African TVETs.

8.3. The main research results

This section concentrates on the results offered in Chapter 6 and articulates conclusions of this paper founded on the objectives set forth in the first chapter. The questionnaire was designed to obtain the specified objectives and validate the discoveries from the literature review.

8.3.1. Sub-objective 1: To investigate the state of the art of knowledge sharing in TVET colleges

The goal of this sub-objective was to discover the current state of KS within South African TVET colleges. The fulfilment of this sub-objective became the baseline of this study as it set the starting point of this research. The findings of this study indicate that the current KS mode in TVET colleges is the traditional face-to-face mode in which the educator and the learners are expected to be together in a room dedicated to the lesson. The training and learning occur at the same time in which all activities and demonstrations of work are considered. It consists of spoken discussions which are temporarily and educator-controlled. Face-to-face allows setting-up of small learning groups and difficult to overlook the educator.

The challenges associated with the current face-to-face knowledge sharing mode in TVET colleges

The findings from the literature review reveal a number of challenges associated with the use of face-to-face KS, namely: the time allocated is too restrictive, and students and the lecturer are bound by geographic location. There is no interaction with the lecturer beyond the classroom. The fact that there is no communication with the lecturer away from the classroom implies that students with learning problems have no

alternate platform which they can use to improve their situation. This is also the case with learners who cannot make it to college for some reasons; they cannot learn away from the college which compromises the quality of education and their success rate. The existing research expresses the importance of KS among peers which are lecturer-to-lecturer and student-to-student which is currently absent in TVET colleges. There is no system in place to ensure KS between lecturer-to-lecturer and student-to-student which plays a crucial role for lecturers when planning for a lesson or lecture and may assist students who could learn from each other as well. Section 6.4.1 indicates that there is no other learning practice beside face-to-face in South African TVET colleges meaning that learning does not occur away from the campus.

8.3.2. Sub-objective 2: To investigate the suitability of e-learning as a mechanism to overcome challenges faced by TVET with regard to knowledge sharing

The findings of this study mentioned in section 8.3.1 indicate that the traditional face-to-face is the currently used KS mode in TVET colleges with no alternative or supplement.

The findings from the literature review indicate that e-learning is capable of overcoming challenges associated with face-to-face. However, none of the TVET colleges are using an e-learning system. Further to that, the results presented in Chapter 6 of this paper indicate that TVET colleges are not ready to offer e-learning due the inadequate network infrastructure available from these colleges. Section B of the survey focused on assessing the usage and availability of internet in participating colleges while Section C focused on the thoughts of TVET stakeholders with regards to the importance of e-learning. In Section B, most respondents (265, 78%) agreed that the internet can be used as a learning platform. Section 6.3.1 illustrates participants' views on the issue of offering learning by means of the internet. However, internet connectivity and speed are of poor quality in most campuses according to the participants (230, 67.8%), with 72 (21.2%) indicating internet to be of good quality and 37 (10.9%) indicating that they were unsure. This is a sign that internet connectivity and speed need to be improved in most campuses

for TVETs to adopt e-learning. Section 6.3.2 illustrates the views of participants with regards to internet connectivity and speed on their campuses.

The benefits of e-learning

The findings from the existing literature showed that e-learning can offer various benefits to KS which may overcome the challenges associated with face-to-face learning. In South African TVET colleges e-learning does not exist, including in the colleges that participated in this study. The benefits associated with e-learning according to the existing literature include:

- *Reduced expenses.* Generating online or offline learning content takes a lot of time. E-learning saves cost through minimised travel, material and general maintenance such as cleaning of the learning venue.
- *More convenient*. E-learning is not dependent on a geographical location nor particular time-slot. Students and lecturers can interact with one another from the comfort of their home.
- *Standardisation*. One may be a good facilitator; however this does not offer the assurance that the modules are taught in a similar manner across sessions. E-learning easily lets one create regular procedures and consistency in the delivery of content.
- *Real-time access*. In traditional face-to-face learning, learning tasks call for those who learn to align their schedules to the learning timetable. With e-learning this is not necessary because modules can be retrieved anywhere, anytime.
- *Improved retention*. The mixture of interactive programmes and educational design offer an extremely fruitful learning practice which can be repeated. It may include excellent practical assignments in which feedback is given back to students. Such learning platforms help students retain the course content and keep students happy and as a result they continue doing the course and this improves the student retention rate (Articulate.com, 2010).

This study challenges TVET colleges to take initiatives and adopt e-learning in order to experience its benefits.

8.3.3. Sub-objective 3: To develop an e-learning framework, on which TVET can rely to effectively and efficiently share knowledge among stakeholders

The purpose of this sub-objective is to ensure that this research attains the e-learning framework on which TVET can rely to effectively and efficiently share knowledge among stakeholders. In the process of getting an e-learning suitable for TVET; the three aspects were found to be central from the current literature. The three aspects are Theoretical foundation of learning, Conceptual Technical Building blocks, e-learning users' requirements and features which were also used as the guide in the development of the survey.

The theoretical foundation of learning

The theoretical foundation of learning is derived from (Khan, 2005)'s online learning framework which is made up of pedagogy, ethics, institutional issues, resource support, industry engagement, interface design, technology. The theoretical foundation of learning form Section D of the survey and the findings from the responses of the participants indicate that all (100%) participants want all the elements of the theoretical foundation of learning to be incorporated in the e-learning framework with the exception of pedagogy which was approved by 327 (96.5%) while 12 (3.5%) were unsure. This foundation of learning should undergo continuous observation and assessment to allow continuous improvement as approved by the participants. Sections 6.6.1 to 6.6.11 illustrate participants' thoughts with regards to this foundation.

Conceptual technical building blocks

The conceptual technical building blocks are taken from (Xiaofei, Abdulmotaleb, & Georganas, 2003)'s facilitation of an e-learning system which was shown in Figure 4.7.2. The conceptual technical building blocks' elements are divided into five layers; which are: **Terminals** (PC/desktop, Laptop, Mobile devices i.e. tablets, smartphones); **Front-end** (Student portal, Lecturer portal, Admin portal and Webmaster portal); **Network channels** (Intranet, Virtual Private Network, Public

Network, Access Control); **Back-end servers** (Application and Registration Web Server, Course Content Server, Communication Server, Assessment and Results Server); **Database** (Application and Registration Database, Course Content Database, Communication Database, Assessment and Results Database). The conceptual technical building blocks form Section E of the survey and the findings from the responses of the participants indicate that all (100%) participants want all the elements of the conceptual technical building blocks to be part of the e-learning framework with the exception of webmaster area which was approved by 334 (98.5%) while 5 (1.5%) were unsure, and importance of controlling access to online learning system which was approved by 335 (98.8%) while 4 (1.2%) were unsure. The application and registration feature is a difficult one in which the findings indicate that 227 (67.0%) participants are of the understanding that it is good to have the application and registration webserver together with the corresponding database as one of the backstage elements to allow online application and registration. However, 71 (20.9%) of the participants were unsure and (41, 12.1%) did not want this. The administrators who are responsible for the application and registration of the learners seemed to be in conflict because from the 38 who participated 14 (36.8%) did not want online application and registration, 16 (42.1%) wanted it while the remaining 8 (21.1%) were unsure. The researcher recommends that colleges must not include online application and registration when setting up e-learning for the first time; online application and registration should be included once the college is satisfied that e-learning is working well for them. These conceptual technical building blocks should undergo continuous observation and assessment to allow continuous improvement as approved by the participants. Sections 6.7.1 to 6.7.16 illustrate participants' thoughts with regards to these building blocks.

E-learning users' requirements and features

E-learning users' requirements and features are of utmost importance. Users' requirements and features help determine system requirements which are hardware, software and non-functional requirements. According to the e-learning users' requirements and features arising from Section F of the survey, the responses of the participants indicate that all (100%) of them want all the elements of the e-learning users' requirements and features to be incorporated in the e-learning framework with

the exception of the inclusion of campus, inter-campus and beyond campus network channels for suitable access to e-learning. This was approved by 334 (98.5%) with only 5 (1.5%) being unsure. E-learning users' requirements and features should undergo continuous observation and assessment to allow continuous improvement as approved by the participants. Sections 6.8.1 to 6.8.7 illustrate participants' thoughts with regards to these requirements and features.

8.3.4. Sub objective 4: To evaluate and validate the framework in a real-life environment of identified TVET colleges

This sub-objective was intended for the overall evaluation and validation of the proposed e-learning framework by TVET stakeholders. The proposed framework was developed based on the findings of the existing research which later underwent evaluation and validation by TVETs using a survey. The findings to be presented in this section are based on what TVET stakeholders' thoughts were on the proposed framework as presented in Chapter 6.

Internet usage and availability in education

According to (Khan, 2005) institutions must engage in self-assessment mechanism in order to establish their own evaluation of online learning preparedness and possible future enhancements. For that reason, it was necessary to check internet usage and availability in the participating TVET colleges as a starting point. The study found that all the colleges who participated in the study do have internet services. However, 230 (67.8%) out of 339 respondents indicated that internet connectivity and speed is poor at their campuses/colleges. It is therefore suggested that internet connectivity and speed must be enhanced for these colleges to be ready to offer learning by means of an internet.

The other finding was that most staff and students (200, 59%) accessed the internet in the internet room or office or Wi-Fi (15, 4.4%) located within the campus/college. This means that both staff and students need to be at the campus to access the internet and this does not solve most problems associated with the use of only face-to-face learning. Further, staff and students who use laptop and mobile devices to

access the internet away from the campus may find it hard to maintain data due to its cost as none of the colleges provide data. It is also recommended that colleges should increase access to the internet via laptops and/or mobile device and fund these to ensure that staff and students may be able to access learning resources beyond the classroom or campus.

Importance of e-learning

This section of the survey aims to respond to sub-objective 1, which is to investigate the state of the art of knowledge sharing in TVET colleges. The findings revealed that face-to-face is the only learning practice used in participating campuses/colleges. The results showed that TVET colleges want e-learning introduced as a complement to face-to-face to help supplement face-to-face by eliminating or minimising its shortcomings. The majority of the participants (302, 89.1%) like to consider e-learning as a complement to face-to-face but not as a replacement, in order to extend access to learning whenever face-to-face is unavailable, and 37 10.9%) were unsure. Substituting face-to-face with e-learning was turned down by the majority of participants 290 (85.5%) with the remainder being unsure.

Theoretical foundation of learning

This section of the survey aimed to respond to sub-objectives 2 and 3. The results revealed that pedagogy, ethics, institutional issues, resource support, industry engagement, interface design and technology should be utilised as part of the theoretical foundation of learning when adopting e-learning. This shows that participants were of the view that online learning must also be guided by rules and regulations in the same way that face-to-face is. The other finding is that the theoretical foundation of learning should be monitored and evaluated regularly in order to maintain the best foundation for responding to current needs.

Conceptual technical building blocks

This section of the survey aimed to respond to sub-objectives 3 and 4. This section was divided into four categories, namely, terminals, front-end portals, network channels and webservers and databases. The results revealed that participants were in support of these four categories as shown in the proposed framework (refer to section 4.3.2). However, most administrative personnel who participated in the study still preferred doing applications and registrations manually. Therefore, the researcher recommends that applications and registrations be excluded from the framework for now and can be considered again in the future should their needs change based on monitoring and evaluation which was approved by all TVET stakeholders.

E-learning users' requirements

This section of the survey aimed to respond to sub-objectives 2 and 4. The focus here was on the needs of the end-users with regards to features and functionalities (refer to section 7.2.5 for more details on the findings associated with e-learning users' requirements). The change made on the improved framework from the proposed one was to exclude the applications and registrations webserver together with the corresponding database. This change was necessary due to administrative personnel's lack of support for online applications and registrations (see section 7.3 for more details).

8.4. Limitations of the study

This section focuses on identifying the limitations of this research with regards to what might be done differently when conditions allow such. (Yin, 2009) states that each study is bound by the restrictions placed upon the investigator and by the environment. Despite the restrictions present in this study, we ensured that data collected was highly reliable and valid in order to realise the research main objective and sub-objectives.

The intention of this research study was to explore the implementation of e-learning in all TVET colleges in South Africa. However, only 18 campuses from 9 colleges across all provinces in South Africa participated in this study which restricted the scope of the research. The outcomes of this research may only be representative of e-learning adoption by South Africa TVET colleges and as a result, may not be generalised to other higher education institutions in South Africa and other TVET institutions outside South Africa. There is a very little research on TVET colleges in South Africa regarding e-learning usage and this matter is considered as a limitation in this study. Furthermore, there is minimal literature on studies of this nature in the African TVET college context and other institutions of higher education within South Africa. As a result, this paper was unable to compare the real outcomes of the traditional face-to-face learning and the e-learning system to confirm the gains of e-learning within South African TVET colleges. In this study we were unable to perform some more complex tests such as reliability, validity, Cronbach alpha and factor analysis tests. Due to constraints, we were unable to use the e-learning framework and framework prototype produced in this paper to develop a real e-learning system which could be practically evaluated by TVET stakeholders. In spite of these limitations, the research outcomes can be generalised to TVET colleges within South Africa and other TVET colleges that have the same interior and exterior environment.

8.5. Further contribution to knowledge

This research makes a number of contributions of new knowledge to current knowledge in the field of learning by means of e-learning at TVET colleges particularly in South Africa. The contributions are:

- This research exposes the deficiency of adequate investigations on the utilisation of the e-learning systems, particularly in South African TVET colleges;
- The crucial contribution to knowledge is the formation of a new e-learning framework suitable for TVET colleges for guiding the development of the e-learning system to support the execution of the e-learning system. As a result, we are hopeful that several institutions may benefit from this new

framework generated in this dissertation, especially institutions who desire to embrace the e-learning system;

- A distinctive framework for the utilisation of an e-learning system has been formed as an enabler of learning to help overcome barriers that exist within the field of KS;
- The e-learning architectural design together with the system prototype to show South African TVET colleges how e-learning can be implemented in real-life;

8.6. Suggestions for future work

The outcomes of this study have shown some loose ends that may possibly not be answered decisively by the data and in view of the limitations of this research as defined above, the research areas below are listed as recommendations for future investigation:

- Surveys in all TVETs in South Africa: research should be conducted by means of a survey in all 50 TVET colleges in South Africa (to avoid misrepresentation of all colleges by the few participating colleges) to discover the complications and difficulties that obstruct the utilisation of e-learning in TVET colleges;
- Perform some more complex tests such as reliability, validity, Cronbach alpha and factor analysis tests.
- Productization of the suggested prototype: development of a real e-learning system which can be practically evaluated by TVET stakeholders;
- Testing of the productised prototype: to compare the real outcomes of traditional face-to-face learning and the e-learning system to confirm the gains of the e-learning system in South African TVET colleges;
- Impact analysis on e-learning systems: after deploying the system in a TVET, a survey must be conducted to determine the impact of e-learning in the TVET to ascertain that it is resolving the challenges faced by traditional system, in particular, in relation to improved success rate and participation among stakeholders;

- Comparative study between face-to-face and technologically enhanced education system: perform a study between TVETs that have adopted e-learning and those that have not and draw conclusions as to whether face-to-face or e-learning or a combination of both is suitable for South African TVET colleges

8.7. Conclusion

The main objective of this study was to develop an e-learning framework for facilitating KS and community of practice in TVET colleges. This objective was achieved in Chapter 4 and further expanded in Chapter 7 through an improved framework based on findings from survey participants. The developed e-learning framework was then used to produce a framework prototype. The framework prototype is an initial example of an e-learning programme which provides institutions with an idea of the basic appearance and impression and functions of a product, without imitating every visual design or function.

This research further identified the current KS model utilised at the TVET colleges that participated in this research. This investigation confirms that public TVET colleges continue to use traditional face-to-face with no alternative or supplementary modes. This investigation showed that the traditional face-to-face mode used by public TVET colleges is not efficient as the students cannot learn beyond campus – learning is still bound by geographic location despite technological advancements. E-learning was found to be suitable for TVET colleges and the prototype of a framework was developed to be utilised as a guide in the development of an e-learning system for TVET colleges seeking to adopt such a system. Due to the limitations that exist in this paper; recommendations for further research have been identified which include surveys in all TVETs in South Africa, productization of the suggested prototype, testing of the productised prototype, impact analysis on e-learning systems and comparative study between face-to-face and technologically enhanced education systems.

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ANNEXURE A: THE SURVEY

PARTICIPANT'S CONSENT LETTER

SURVEY: E-LEARNING FOR KNOWLEDGE MANAGEMENT IN TECHNICAL VOCATIONAL EDUCATION AND TRAINING COLLEGES

Ethical clearance #: 1

Research permission #: 1

COVER LETTER TO AN ANONOMOUS SURVEY INCLUDING ONLINE WEB-BASED SURVEY

Dear Prospective participant,

You are invited to participate in a survey conducted by Mr Ntokozo M. Dhlamini under the supervision of Prof. Ernest Ngassam, a Professor in the School of Computing towards an MTech in Information Technology at the University of South Africa.

The survey you have received has been designed to study the e-Learning for Conducting Lessons in Technical Vocational Education and Training Colleges. You were selected to participate in this survey because you are directly affected by the study and have a lot to contribute in the process of getting the suitable e-learning framework for TVET Colleges. You will not be eligible to complete the survey if you are younger than 18 years. By completing this survey, you agree that the information you provide may be used for research purposes, including dissemination through peer-reviewed publications and conference proceedings.

It is anticipated that the information we gain from this survey will help us develop an e-learning framework for facilitating Knowledge sharing and community of practice in TVET Colleges. You are, however, under no obligation to complete the survey and you can withdraw from the study prior to submitting the survey. The survey is developed to be anonymous, meaning that we will have no way of connecting the information that you

provide to you personally. Consequently, you will not be able to withdraw from the study once you have clicked the send button based on the anonymous nature of the online survey or handing it back for manual survey. If you choose to participate in this survey it will take up no more than fifteen (15) minutes of your time. You will not benefit from your participation as an individual, however, it is envisioned that the findings of this study will help TVET Colleges in the adoption of an e-learning system to supplement learning. The benefits of this study will include providing TVET Colleges with an additional, suitable learning platform and increase access to learning where students can learn wherever they may be through the use of an e-learning. We do not foresee that you will experience any negative consequences by completing the survey. The researcher(s) undertake to keep any information provided herein confidential, not to let it out of our possession and to report on the findings from the perspective of the participating group and not from the perspective of an individual.

The records will be kept for five years for audit purposes where after it will be permanently destroyed where hard copies will be shredded and electronic versions will be permanently deleted from the hard drive of the computer. You will not be reimbursed or receive any incentives for your participation in the survey.

The research was reviewed and approved by the Department of Computer, Science, Engineering and Technology's Ethics Review Committee. The primary researcher, Mr Ntokozo Mazwikayise Dhlamini, can be contacted during office hours at 072 303 0270 or ndhlamini07@gmail.com. The study leader, Prof. Ernest Ketcha Ngassam, can be contacted during office hours at 082 355 2519 or eketcha@gmail.com. Should you have any questions regarding the ethical aspects of the study, you can contact the chairperson of the Department of Computer, Science, Engineering and Technology's Ethics Research Committee at 011 670 9429 or SocEthics_IS@unisa.ac.za. Alternatively, you can report any serious unethical behaviour at the University's Toll Free Hotline 0800 86 96 93.

You are making a decision whether or not to participate by continuing to the next page. You are free to withdraw from the study at any time prior to clicking the send button for online survey or handing it back for manual survey.

The contributions made by participants will be anonymous (i.e. information provided will not be linked to an individual).

SURVEY:

E-LEARNING FOR KNOWLEDGE MANAGEMENT IN TECHNICAL VOCATIONAL EDUCATION AND TRAINING COLLEGES

SURVEY PURPOSE

A survey is conducted to allow stakeholders of TVET Colleges, particularly the experts to evaluate the proposed e-learning framework to see whether it is suitable for TVET Colleges or not. The contributions made will then be used to come up with the improved e-learning framework suitable for TVET Colleges. **The contributions made by participants will be anonymous (i.e. information provided will not be linked to an individual).**

This survey closes on the 30th of November 2017. For all your enquiries e-mail them to **ndhlamini07@gmail.com** or **49041258@mylife.unisa.ac.za**.

Kindly complete the survey underneath by putting a cross (**X**) next to your most suitable response. Answer ALL the questions (1 – 50).

SECTION A: BIOGRAPHICAL INFORMATION

1. Specify your gender.

	Female		Male

2. Please indicate your age group from the options below.

	18 – 25		26 – 35		36 – 45		46 – 55		56 – 65		Over 65

3. Specify the position held within the organisation where you are, from the options below.

	Principal
	Campus Manager
	Subject Specialist
	Lecturer
	Student
	IT Expert
	Administrator

4. How long have you been in this organisation (in years)?

	0 – 5		6 – 10		11 – 15		16 – 20		21 – 25		Over 25

5. What highest qualification(s) do you currently possess?

	Gr 9		Gr 10		Gr 11		Gr 12		H. Cert
	Diploma		Degree		Hons		Masters		PhD

6. In which area is your campus located?

	Urban		Township		Rural

SECTION B: INTERNET USAGE AND AVAILABILITY IN EDUCATION

7. Please state your opinion on the following statement: Learning should be offered to students using internet as a platform:

☐ Strongly agree	☐ Agree	☐ Not sure	☐ Disagree	☐ Strongly disagree

8. Does the institution have access to internet? If yes, how good is the internet in terms of connectivity and speed?

☐ Very good	☐ Good	☐ Not sure	☐ Poor	☐ Very poor

9. How accessible is the internet to the staff of the TVET?

☐ Internet room	☐ Mobile device	☐ Laptop	☐ Wi-Fi	☐ None	☐ Not sure

10. How accessible is the internet to the students of the TVET?

☐ Internet room	☐ Mobile device	☐ Laptop	☐ Wi-Fi	☐ None	☐ Not sure

SECTION C: IMPORTANCE OF E-LEARNING

11. What other learning practices do you have besides normal face-to-face learning?

☐ Social media	☐ E-learning	☐ Both	☐ None

12. How effective is the alternative learning approach beside face-to-face?

☐ Very good	☐ Good	☐ Does not exist	☐ Poor	☐ Very poor

13. How widely spread is the approach beside face-to-face?

☐ Very good	☐ Good	☐ Does not exist	☐ Poor	☐ Very poor

14. Would you consider e-learning as a complement to face-to-face?

☐ Strongly agree	☐ Agree	☐ Not sure	☐ Disagree	☐ Strongly disagree

15. Would you consider e-learning as an alternative to face-to-face?

☐ Strongly agree	☐ Agree	☐ Not sure	☐ Disagree	☐ Strongly disagree

16. Would you consider e-learning as a coexisting approach for enhanced handing over?

☐ Strongly agree	☐ Agree	☐ Not sure	☐ Disagree	☐ Strongly disagree

SECTION D: THEORETICAL FOUNDATION OF LEARNING

17. It is appropriate to include pedagogy (states how the content of a course is designed; recognises the learner's needs; and how the learning outcomes should be realised) in a theoretical foundation of learning for TVET to be effective.

	Strongly agree		Agree		Not sure		Disagree		Strongly disagree

18. The ethics play a crucial role in ensuring that matters concerning social and political influence, diversity, unfairness, information availability, good manners, and legal issues be handled with care within TVET.

	Strongly agree		Agree		Not sure		Disagree		Strongly disagree

19. It is quite important to consider looking at institutional issues which comprised of administrative matters, academic affairs and student services within TVET when introducing e-learning.

	Strongly agree		Agree		Not sure		Disagree		Strongly disagree

20. The resource support should be part of the TVET theoretical foundation of learning as it considers all the support required for human and technical resources in order to build significant and fruitful online learning environments.

	Strongly agree		Agree		Not sure		Disagree		Strongly disagree

21. Industry engagement should be part of the TVET theoretical foundation of learning as it ensures that TVET produces students that are adequately trained for an industry or workplace.

	Strongly agree		Agree		Not sure		Disagree		Strongly disagree

22. The interface design should be included in the TVET theoretical foundation of learning as it ensures that system design, content design, navigation, course availability and usability testing; improves learning.

	Strongly agree		Agree		Not sure		Disagree		Strongly disagree

23. Technology is an enabler of learning and should be included in the TVET theoretical foundation of learning as it enhances access to learning.

	Strongly agree		Agree		Not sure		Disagree		Strongly disagree

24. It is appropriate for pedagogy, ethics and institutional to be grouped together under Regulations.

	Strongly agree		Agree		Not sure		Disagree		Strongly disagree

25. It is appropriate for resource support, industry engagement and interface design to be grouped together under Managed Services.

	Strongly agree		Agree		Not sure		Disagree		Strongly disagree

26. Technology should be on its own as an enabler of learning.

	Strongly agree		Agree		Not sure		Disagree		Strongly disagree

27. The observation and assessment of the theoretical foundation of learning should be conducted continuously to ensure the best foundation.

	Strongly agree		Agree		Not sure		Disagree		Strongly disagree

SECTION E: CONCEPTUAL TECHNICAL BUILDING BLOCKS

28. The desktop/PC should be one of the devices to ensure access is granted to users in a specific location.

	Strongly agree		Agree		Not sure		Disagree		Strongly disagree

29. The laptop should be one of the devices available to ensure access is granted to users wherever they go.

	Strongly agree		Agree		Not sure		Disagree		Strongly disagree

30. The mobile device should be one of the devices available to ensure access is granted to online learning using any of the smartphone.

	Strongly agree		Agree		Not sure		Disagree		Strongly disagree

31. It is good to have a student area as one of the available items to ensure students have a specialised access to online learning where access is limited to what they need.

	Strongly agree		Agree		Not sure		Disagree		Strongly disagree

32. It is good to have a lecturer's area as one of the available areas to ensure lecturers have a specialised access to online learning where access is limited to what they need.

	Strongly agree		Agree		Not sure		Disagree		Strongly disagree

33. The admin area should be one of the areas available to ensure administrators have a specialised access to online learning where access is limited to what they need.

	Strongly agree		Agree		Not sure		Disagree		Strongly disagree

34. It is good to have a webmaster area as one of the areas available to ensure webmasters have specialised access to online learning where access is limited to what is expected from them.

	Strongly agree		Agree		Not sure		Disagree		Strongly disagree

35. The campus network should be one of the networks to ensure access is granted to online learning within a campus of an institution.

	Strongly agree		Agree		Not sure		Disagree		Strongly disagree

36. The inter-campus network should be one of the networks to ensure access is granted to online learning across campuses of an institution.

	Strongly agree		Agree		Not sure		Disagree		Strongly disagree

37. The public network should be one of the networks to ensure TVET stakeholders and the public are granted access to online learning away from an institution.

	Strongly agree		Agree		Not sure		Disagree		Strongly disagree

38. To ensure that only authorised personnel have access, it is quite important to control access to an online learning system under network channels.

	Strongly agree		Agree		Not sure		Disagree		Strongly disagree

39. It is good to have application& registration webserver together with the corresponding database as one of the back stage elements to allow online application & registration.

	Strongly agree		Agree		Not sure		Disagree		Strongly disagree

40. It is essential to have course content webserver together with the corresponding database as one of the back stage elements to allow online course content offering.

	Strongly agree		Agree		Not sure		Disagree		Strongly disagree

41. It is essential to have communication webserver together with the corresponding database as one of the back stage elements to allow online communication among stakeholders.

	Strongly agree		Agree		Not sure		Disagree		Strongly disagree

42. It is quite important to have assessment & results webserver together with the corresponding database as one of the back stage elements to allow online assessments and issuing of results.

	Strongly agree		Agree		Not sure		Disagree		Strongly disagree

43. The observation and assessment of the conceptual technical building blocks should be continuously to ensure the best concept.

	Strongly agree		Agree		Not sure		Disagree		Strongly disagree

SECTION F: E-LEARNING USERS' REQUIREMENTS

44. The e-learning system should be responsive and adaptive (i.e. flexible) to allow access to it when using desktop/PC, Laptop and Mobile.

	Strongly agree		Agree		Not sure		Disagree		Strongly disagree

45. The campus, inter-campus and beyond campus network channels are appropriate for suitable access to e-learning.

	Strongly agree		Agree		Not sure		Disagree		Strongly disagree

46. The student area should allow students to use features and functionalities:
Online application & registration (incl. uploading documents, updating applications & registrations);
Access course content (limited to modules enrolled for),
Communicate (with Lecturers regarding academic affairs, administration personnel for administrative matters, and website master for technical/system support using e-mail, discussions and chats) and
Assessment & Results (do assessments and receive results).

	Strongly agree		Agree		Not sure		Disagree		Strongly disagree

47. The lecturer area should allow lecturers to use features and functionalities:
Online application & registration (access students assigned to them per module and keep track of students' online attendance);
Access course content (be able to share with their students: video, presentation and documents),
Communicate (with students for academic affairs, administration personnel for administrative matters, and website master for technical/system support using e-mail, discussions and chats) and
Assessment & Results (upload and download assessments and issue the results to administration).

	Strongly agree		Agree		Not sure		Disagree		Strongly disagree

48. The admin area should allow admin personnel to use features and functionalities:
Online application & registration (monitor and manage students' enrolments, assign students to lecturers per module and keep track of students' online attendance);
Access course content (ensure course content and study material is available to students),
Communicate (with lecturers regarding academic affairs, students for administrative matters, and website master for technical/system support using e-mail, discussions and chats) and
Assessment & Results (upload and download assessments and issue the results to students).

	Strongly agree		Agree		Not sure		Disagree		Strongly disagree

49. The website master area should allow technical/system support to use features and functionalities:
Online application & registration (offer technical/system support using e-mail, discussions and chats);
Access course content (offer technical/system support using e-mail, discussions and chats),
Communicate (offer technical/system support using e-mail, discussions and chats) and
Assessment & Results (offer technical/system support using e-mail, discussions and chats).

	Strongly agree		Agree		Not sure		Disagree		Strongly disagree

50. The observation and assessment of the e-learning users' requirements should be conducted regularly to continuously improve the features and functionalities of the system.

	Strongly agree		Agree		Not sure		Disagree		Strongly disagree

THANK YOU FOR YOUR TIME AND CONTRIBUTION, SURVEY COMPLETED!

ANNEXURE B: THE APPLICATION TO CONDUCT RESEARCH IN PUBLIC COLLEGES

higher education & training
Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

DHET 004: APPENDIX 1:

APPLICATION FORM FOR STUDENTS TO CONDUCT RESEARCH IN PUBLIC COLLEGES

1. APPLICANT INFORMATION

1.1.	Title (Dr /Mr /Mrs /Ms)	Mr	
1.2	Name and surname	Ntokozo Mazwikayise Dhlamini	
1.3	Postal address	P O Box 10022 NEWCASTLE 2940	
1.4	Contact details	Tel:	034 318 1206
		Cell:	072 303 0270
		Fax:	086 574 7431
		Email:	ndhlamini07@gmail.com
1.5	Name of institution where enrolled	University of South Africa (UNISA)	
1.6	Field of study	Information Technology	
1.7	Qualification registered for:	*Please tick relevant option:*	
		Under-graduate Degree	
		Honours Degree	
		Master's Degree	✓
		Doctoral Degree (PhD)	

2. DETAILS OF THE STUDY

2.1	Title of the study
	e-Learning for Knowledge Management in Technical Vocational Education and Training Colleges

DHET 004: APPENDIX 1: APPLICATION FORM FOR STUDENTS TO CONDUCT RESEARCH IN PUBLIC COLLEGES

2.2	Main purpose of the study
	The purpose is to develop an e-learning framework for facilitating knowledge sharing and community of practice in TVET colleges.

3. SUPPORT NEEDED FROM THE INSTITUTION

Please indicate the type of support required from the institution (Please tick relevant option/s)			
Type of support		Yes	No
3.1	The institution will be required to identify participants and provide their contact details to the researcher.		✓
3.2	The institution will be required to distribute instruments to participants on behalf of the researcher.		✓
3.3	The institution will be required to provide official documents. *Please specify the documents required below*	✓	
	The "terms and conditions for internet usage" in TVET colleges.		
3.4	The institution will be required to provide data. *Please specify the data required below*	✓	
	The "terms and conditions for internet usage" in TVET colleges to guide the development of an e-learning framework.		
3.5	*Other, please specify below*	✓	
	The number of computers with internet access per campus.		

4. TYPE/S OF ACTIVITIES TO BE UNDERTAKEN IN THE INSTITUTION

Please indicate who is expected to participate in your study (for example, lecturers, students, College Principals, campus Heads, support staff, Heads of Departments).			
		Expected participants	Number of participants
4.1	Complete questionnaires	a)	
		b)	
		c) N/A	N/A
		d)	
		e)	

DHET 004: APPENDIX 1: APPLICATION FORM FOR STUDENTS TO CONDUCT RESEARCH IN PUBLIC COLLEGES

4.2	Participate in individual interviews	Expected participants a) b) c) d) e)	Number of participants N/A
4.3	Participate in focus group discussions/ workshops	Expected participants a) b) c) d) e)	Number of participants N/A
4.4	Complete standardised tests (e.g. Psychometric Tests)	Expected participants a) b) c) d) e)	Number of participants N/A
4.5	*Other, specify below* Survey	a) College Principals b) Campus Managers c) Education Specialists d) and/or Lecturers	04 04 05 05
4.6	Undertake observations *Please specify in the column on the right*	---------- N/A ----------	

5. DOCUMENTS TO BE ATTACHED TO THE APPLICATION

The following 2 (two) documents must be attached as a prerequisite for approval to undertake research in the institution	
5.1	Ethics Clearance Certificate issued by a University Ethics Committee
5.2	Research proposal

DHET 004: APPENDIX 1: APPLICATION FORM FOR STUDENTS TO CONDUCT RESEARCH IN PUBLIC COLLEGES

6. DECLARATION BY THE APPLICANT

I undertake to use the information that I acquire through my research, in a balanced and a responsible manner. I furthermore take note of, and agree to adhere to the following conditions:

a) I will schedule my research activities in consultation with the said institution and participants. I will not interrupt the said institution's programmes.

b) I agree that involvement by participants in the research study is voluntary, and that participants have a right to decline to participate in the investigation.

c) I will therefore provide consent forms to participants to complete prior to the commencement of the research.

d) I will obtain written parental consent of students under 18 years, if they are expected to participate in the study.

e) I will honour the right of participants to privacy, anonymity, confidentiality and respect for human dignity at all times. Participants will not be identifiable in any way from the result of the investigation.

f) I will not include the names of the said institution or research participants in my research report, without the written consent of each of these individuals and/or institutions.

g) I will not use the resources of the said institution (such as stationery, photocopies, faxes, and telephones) for the research study.

h) I will inform participants about the use of monitoring devices such as tape-recorders and cameras, and participants will be free to reject them if they wish.

i) I will include a disclaimer to any report, publication or presentation arising from the investigation, that the findings and recommendations does not represent the views of the said institution.

j) I will provide a summary of the findings of the research to the Head of the specific institution.

I declare that all statements made in this application are true and accurate. I accept the conditions associated with the granting of approval to conduct research and undertake to abide by them.

SIGNATURE:	
DATE:	31/01/2017

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FOR OFFICIAL USE

DECISION BY HEAD OF INSTITUTION

Please tick relevant decision and provide conditions/reasons where applicable		
Decision		*Please tick relevant option*
1	Application approved	✓
2	Application approved subject to certain conditions. *Specify conditions below.*	
3	Application not approved. *Provide reasons for non-approval below.*	
NAME AND SURNAME:	ZB MCABIYE	
SIGNATURE:		
DATE:	07/02/17	

MAJUBA TVET COLLEGE
CENTRAL OFFICE
07 FEB 2017
TEL: 034 - 326 4888
PRIVATE BAG X6602
NEWCASTLE 2940

APPENDIX A: TURNITIN ORIGINALITY REPORT

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APPENDIX B: EDITING CERTIFICATE

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Email: rsteele@telkomsa.net

EDITING CERTIFICATE

Re: **Ntokozo Mazwikayise Dhlamini**
Master's dissertation: **-Learning for Knowledge Management in Technical Vocational Education and Training Colleges**

I confirm that I have language edited this dissertation. I was not contracted to edit reference style and check accuracy of references. I am a freelance editor specialising in proofreading and editing academic documents. I returned the document to the author with track changes so correct implementation of the changes in the text and references is the responsibility of the author. My original tertiary degree which I obtained at the University of Cape Town was a B.A. with English as a major and I went on to complete an H.D.E. (P.G.) Sec. with English as my teaching subject. I obtained a distinction for my M.Tech. dissertation in the Department of Homeopathy at Technikon Natal in 1999 (now the Durban University of Technology). During my 13 years as a part-time lecturer in the Department of Homoeopathy at the Durban University of Technology I supervised numerous Master's degree dissertations.

Dr Richard Steele
05 August 2018
per email